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THE INFLUENCE OF AGE-DETERMINED FACTORS ON THE DEVELOPMENT OF TUBERCULOSIS*

ARNOLD RICE RICH, M.D.

Associate Professor of Pathology and Bacteriology, The Johns Hopkins Medical School

Baltimore, Maryland

IT IS now well known that at different periods of the life span there are striking differences in the clinical manifestations, the prognosis, the character of the lesions, the mortality rate and the epidemiology of tuberculosis.

The recognition of the existence of these age-period differences has become essential for the proper interpretation of the disease, whether by the clinician, the pathologist or the epidemiologist. For the proper understanding, and for the most effective control of the disease it is of great importance that we learn precisely to what these age-period peculiarities are due. Unfortunately, our information about this matter is sadly deficient at present. The problem is a large one, with many ramifications; and each particular age-period is sufficiently complex to warrant an extended discussion of the factors peculiar to it. I cannot hope, therefore, to do justice to the consideration of all of the different age periods in a single lecture; but it may be worth while to attempt a review of the situation, even though no other end is achieved than that of defining and emphasizing the rather narrow limits of our present information regarding this important and arresting subject.

One of the most fundamental questions involved in the problem, and one that has aroused much interest and speculation, is that relating to the degree of native resistance to tuberculosis possessed by the human body at the different periods of life. By "native resistance" we mean, of course, the inherent ability of the body to destroy or to prevent the progressive proliferation of the bacillus on first contact with it. Is this inherent ability different at different periods of life, independently of external circumstances? Throughout the following discussion we shall pay particular attention to this question.

The characteristic and consistent differences in the tuberculosis mortality rate at the different periods of life have been regarded by many as sufficient evidence that there are corresponding differences in native resistance at the various age periods. Simple mortality rates, however, do not in themselves throw any certain light upon differences in native resistance, for they are influenced too greatly by the complicating factor of resistance acquired through previous infection, by the external influences that are peculiar to each age period and which exert a potent effect upon resistance, and, most important, by the incidence of infection in the population at the different age periods. Resistance is the ability to restrain the progress of infection. In a consideration of resistance at a given age period, therefore, we are interested not in the number of deaths in relation to the total number of individuals of that age (i.e., the general mortality rate), but only in the number of deaths in relation to the *infected* portion of that age group. In other words, the only figures of any suggestive import in relation to resistance are those which tell us whether a larger or a smaller proportion of the *infected* population in a given age period die from the disease, as

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TABLE I. TWENTY RECENT TUBERCULIN SURVEYS

List restricted to surveys in which final test dose was not less than 1.0 mg. O.T. or equivalent amount PPD.

Place of Survey	Author	Date	Per Cent Positive Reactions in Each Age Group								
			0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 and over
Rural Alabama*	Aronson	1933	27.3	36.4	44.4	76.2	84.2	53.8	81.8	80.0	81.0
Rural Florida*	Aronson	1933	17.7	20.6	33.3	62.1	61.7	81.4	72.4	65.7	83.3
Rural Michigan	Aronson	1935	6.1	9.6	17.8	26.4	41.0	52.4	54.4	72.1	76.4
Rural Tennessee*	Aronson	1933	–	36.8	60.8	67.4	–	–	–	–	–
Rural New York Schools	Korns	1931	–	7.0	10.8	16.0	–	–	–	–	–
Rural Minn. Schools	Leggett and Callahan	1931	–	–	–	31.5	–	–	–	–	–
Philadelphia Clinic*	Aronson and Nicholas	1933	14.1	20.0	42.8	–	–	–	–	–	–
Philadelphia Schools*	Hetherington, et al.	1934	–	60.2	76.0	83.0	–	–	–	–	–
Schools near Boston	Aronson et al.	1933	–	28.5	41.5	62.6	–	–	–	–	–
Waverly, Mass. Institution	Aronson et al.	1933	–	39.4	55.7	75.5	–	–	–	–	–
Minneapolis, Minn. Schools	Harrington et al.	1937	–	14.5	20.2	–	–	–	–	–	–
Pine City, Minn. Schools	Leggett and Callahan	1931	–	–	22.3	32.6	–	–	–	–	–
Univ. Wisconsin and High School	Stiehm	1935	–	–	19.4	23.3	36.8	50.1	–	–	–
New York City Schools	Barnard et al.	1931	–	–	67.3	–	–	–	–	–	–
Yale Univ. Students	Soper and Wilson	1932	–	–	–	53.5	58.1	–	–	–	–
Bellevue Hosp., N.Y. Entering nurses	Amberson	1936	–	–	–	57.9	–	–	–	–	–
St. Paul, Minn., Hosp. Entering nurses	Greer	1934	–	–	–	30.0	–	–	–	–	–
18,774 Students in 20 Colleges	Long and Seibert	1937	–	–	–	44.6	–	–	–	–	–
Univ. Pa. 1st year Medical Students	Hetherington et al.	1935	–	–	–	–	85.0	–	–	–	–
47,358 tests in 30 states	Whitney and McCaffery	1937	24.6	23.3	33.4	36.3	–	–	–	–	–
Average			17.9	28.6	38.9	48.6	61.1	–	–	–	–

*White subjects only.

compared with the mortality rate of the infected population in a different period of life. It is this relationship that we shall first proceed to examine.

At the very outset of this enquiry we encounter the first of our many difficulties and uncertainties, in the circumstance that no accurate information exists regarding the incidence of infection in the different age groups of the population at the present time. There are no recent representative autopsy studies of the matter, and no sufficient number of properly carried out and properly distributed tuberculin surveys made since 1930; and in the face of the rapidly declining tuberculosis mortality, figures for some years back cannot with propriety be mixed with the more recent ones.

In Table I, I have assembled the results of twenty representative tuberculin surveys reported in this country since 1930. The gaps in the available material are impressively evident. Particularly is there a dearth of representative material relating to adults, for the figures for college students can hardly be regarded as a fair average of the population. In the past, when it seemed established that the great majority of adults were infected, the position was adopted that nothing profitable could be learned from further tuberculin-testing of adults, and it became the practice to concentrate attention upon the incidence of infection in children. This attitude has persisted up to the present. In view of the markedly altered mortality rate of today, however, it becomes highly desirable that both rural and urban surveys of the incidence of infection in adults of all ages be undertaken again, and on a country-wide scale.

Studies of the incidence of infection in the first year of life are also urgently needed. At present there are only fragmentary figures on unrepresentative material, so that any estimate of the present day incidence of infection in the first year must represent only an individual guess.

In attempting to form an opinion regarding the incidence of infection from tuberculin surveys, there arises the important question as to the frequency with which a negative test may occur in persons who have been previously infected. It is commonly assumed that only in exceptional cases will the test be negative in healthy persons who have been previously infected, if 1.0 mg. of Old Tuberculin be used. Certainly, in the past, our information tended to support that view, but in the face of the markedly changed conditions it becomes possible that the results of the tuberculin test in present day surveys no longer mirror so well the actual incidence of infection. One disturbing element is that we do not know the average duration of tuberculin sensitiveness following a slight, well-resisted infection, and this clearly is a matter of importance in the interpretation of the results of tuberculin tests in terms of incidence of infection.

That hypersensitivity, once established, by no means invariably remains at a level detectable by the routine tests has long been well known. This was plainly shown by Austrian[4] fifteen years ago, and all investigators who have studied the matter thoroughly are agreed on this, though there are differences of opinion as to the usual duration of manifest hypersensitivity, and the frequency with which it falls to a level too low to be detected by the routine tests. Evidence is rapidly accumulating, however, which leaves no doubt that hypersensitivity to tuberculin may be lost with a frequency which, under present conditions of infection, has to be seriously considered in any evaluation of the results of tuberculin surveys. To make this clear it will suffice to call attention to a number of recent studies, all carried out by experienced and able investigators. Barnard, Amberson and Loew[5] found that of 184 school children between twelve and fifteen years of age who had tuberculous lesions demonstrable by x-ray, 6 per cent failed to react to 1.0 mg. of Old Tuberculin. Wells and Smith[53] found demonstrable x-ray lesions in 5.5 per cent of 128 individuals negative to 1.0 mg. of tuberculin. The careful studies of Opie and his associates[25,38] on children between five and nineteen years showed that 15 per cent of 186 who were negative to 1.0 mg. of tuberculin had definite x-ray evidence of tuberculous infection. Crabtree, Hickerson and Hickerson[15] have recently reported a study in persons over four years of age who were negative to 1.0 mg. of carefully standardized tuberculin. Seventeen per cent of those tuberculin-negative individuals were found to have calcified lesions on x-ray examination. Dr. Gauld, of the Department of Epidemiology in the Johns Hopkins School of Public Health, has recently shown me the results of an extensive study, soon to be published, in which an even higher percentage of definite calcified lesions in the lungs and bronchial nodes was found in healthy individuals completely negative to 1.0 mg. of carefully standardized Old Tuberculin; and Nelson, Mitchell and Brown[36] have recently reported similar results.

Since it is well known that the x-ray reveals the primary lesion in only a small percentage of all who do react to tuberculin and are therefore known to be infected, it is clear that the total number of infected persons among those who fail to react must be much larger that the number discovered by x-ray in the above-mentioned studies.

It can hardly be objected that the x-ray interpretation of all of these experienced students of tuberculosis were erroneous, and that the lesions observed in their tuberculin negative subjects were not really tuberculous. As a matter of fact, I know that in Dr. Gauld's study the figures for the presence of calcified tuberculous lesions in negative reactors were so high that he had the plates checked by four independent specialists in different cities in order to rule out errors of individual interpretation. But even such a possible objection is met by investigations in which the change from the hypersensitive to the tuberculin negative state has been directly observed. Thus, Lloyd and MacPherson[30] report from England that of 303 healthy London children who reacted to 1.0 mg. of Old Tuberculin in 1930, 2 per cent were negative to that dose two years later; and Aronson,[2] who has had so extensive an experience in tuberculin surveys in this country, has followed eighty-seven tuberculin-positive urban children for a period of five years, during which time 9 per cent became negative to 1.0 mg. of carefully standardized Old Tuberculin. In a private school that was free from cases of open tuberculosis, Horan,[27] tested 197 adolescent boys yearly for three successive years. During this time 14 per cent of those who were tuberculin-positive on the first test had lost their hyper-

sensitivity to 1.0 mg. of tuberculin. In a recent study, Paretsky[42] reports that out of a group of tuberculin-positive children that were followed up to five years, 80 became negative to 1.0 mg. of Old Tuberculin. Sixty-four per cent of these were retested with 10.0 mg. and failed to react. In animals remaining in good health after having resisted a tuberculous infection, hypersensitivity may fall to so low a level after the lapse of one to two years following infection, that very large doses of tuberculin fail to produce any reaction; and it is very important to remember in relation to the human being that it has been demonstrated by Willis[54] that the animals that lose their sensitivity with the passing of time retain in high degree the resistance to reinfection that was conferred by the original infection. Sewall and his co-workers[47] and Boquet[7] have likewise shown that as hypersensitivity declines acquired resistance remains intact; and numerous studies from our own laboratory, confirmed by many subsequent investigations, have demonstrated that when hypersensitivity is deliberately abolished by proper desensitizing procedures, immunity to reinfection remains in high degree.[44] In the human being, therefore, not only is a negative tuberculin test no proof that the individual has never been infected, but it is also no proof that acquired resistance is lacking.

These considerations obviously have an important bearing upon the proper interpretation of the results of tuberculin surveys. In the first part of this century, when the mortality and morbidity from tuberculosis were very high, and open cases were far more numerous in the population than they are today, individuals who became infected once had a greater opportunity to become infected again and again throughout their lives, and so to have their hypersensitiveness frequently restimulated. Today, however, the spectacular decline in mortality and morbidity (and, therefore, in the number of open cases) has greatly decreased the opportunities for chance contact with the bacillus. The marked diminution in the number of open cases must influence not only the total number of individuals who will become infected at each age period, but also the number and frequency of repeated reinfections. Under these conditions it is reasonable to believe that a correspondingly larger number of individuals in the population today are escaping the hypersensitivity—reanimating influence of reinfections after having lost the sensitivity conferred by a primary infection. It cannot be assumed, therefore, that the number who fail to react to tuberculin in a given survey in this country today approximates the number who have never been infected as closely as may have been the case in the early part of this century.

It is highly desirable to learn to what degree any present day diminution in the number of positive reactors reflects an actual decline in the number of primary infections, and to what degree it is due to a lessened opportunity for reinfections which maintain hypersensitivity at a level detectable by the routine tests. Large scale minute studies of the incidence of primary infections and reinfections in routine autopsies, such as those that were carried out some years ago during the period in which the opportunities for infection were much greater, are urgently needed in order that we may gain a better insight into the actual present-day incidence of infection in the different age groups.

In order to make clear how badly such studies are needed, I shall only remind you that for many years throughout the world it has been regarded as an established fact that the so-called adult type of pulmonary tuberculosis, characterized by apical or sub-apical localization, prominent fibrosis, the failure to involve regional lymph nodes appreciably, and by little tendency to generalization, develops only as a result of *reinfection* in persons who previously have had a partially immunizing, primary infection; and that if progressive disease develops directly as a result of *primary* infection, it will have the characteristics familiar in progressive childhood tuberculosis, namely, localization anywhere in the lung with the apex as the least frequent site, prominent caseation and little fibrosis, marked involvement of regional lymph nodes, and marked tendency to generalization. Now there is much experimental, clinical and pathological evidence in support of this deep-rooted belief, and as long as practically all individuals in urban communities were known to have had a primary infection by the time adult life was reached there was little to disturb that view. At present, however, we are told, on the basis of tuberculin surveys, that only about half of all young adults carry a primary infection. If this be true, and if our long-held attitude toward the adult and childhood type of tuberculosis be correct, we should today be encountering on all sides, both

TABLE II.
U. S. Registration Area, 1932

Age	Total Deaths From Tuberculosis	Estimated Per Cent Infected*	Tbc. Deaths per 100,000 Persons of this Age			Tbc. Deaths per 100,000 Infected Persons of This Age
			Male	Female	Both Sexes	Both Sexes
0–1	834	1	43.0	38.1	40.6	4060
1–4	1718	10	19.9	20.5	20.1	201
5–9	989	25	8.2	7.8	8.0	32
10–14	1332	35	8.7	14.0	11.3	31
15–19	4912	45	31.2	55.2	43.3	96
20–24	8853	55	68.0	98.1	83.3	151
25–29	8672	65	83.2	97.1	90.3	135
30–34	7787	75	93.0	82.1	87.5	114
35–39	7566	85	99.4	68.2	84.0	100
40–44	6746	90	107.0	62.9	85.7	94
45–49	6014	90	113.2	58.8	87.0	96
50–54	5143	90	115.6	58.5	88.2	98
55–59	4304	90	124.3	61.9	94.3	104
60–64	3395	90	118.6	65.2	92.6	103
65–69	2756	90	119.1	83.6	101.9	113
70–74	2301	90	138.5	100.5	119.7	133
75 and over	2101	90	116.6	102.9	109.4	121

*Estimated from recent tuberculin surveys. The figures for some of the age periods are probably too low. See text for question of reliability of tuberculin surveys as indicators of the true incidence of infection.

clinically and pathologically, many instances of progressive tuberculosis of the childhood type developing in the great number of young adults who, according to the tuberculin surveys, have never had a previous, immunizing infection. This, however, is not the case. Young adult tuberculosis, both at the bedside and at the autopsy table, has today precisely the same characteristics as that during the period when primary infection in urban adults was almost universal. In this connection it is of particular interest to note that in the recent study carried out by Myers and his co-workers[33] on tuberculous infection developing in young adults who were regarded as never having been previously infected because they were negative to tuberculin shortly before the lesions appeared, in the overwhelming majority of those cases the lesions were apical or sub-apical and were typical of the adult type of the disease. Were these, then, really instances of primary infection, or were they instances of reinfection in individuals who had lost their hypersensitivity? This question has to be considered the more seriously since Arborelius[1] has described cases of apparently true primary infection occurring in tuberculin-negative young adults from rural districts in Sweden, and in those cases the lesions were never apical but were typical of those characteristic of primary infection in childhood; and instances of typical, progressive childhood-type tuberculosis in young adults were observed at autopsy by Hart[24] in the German army during the World War.

These circumstances should make it clear that either our long-held concept of the pathogenesis of adult type tuberculosis requires a drastic revision, or else that many individuals who today are tuberculin negative have really been infected, and have retained their acquired resistance to the degree that determines the peculiarities of adult type tuberculosis, but have lost their hypersensitivity, and under present conditions of diminished opportunity for reinfection they remain tuberculin negative for longer periods than would have been the case formerly. Only a minute search for healed lesions with the aid of the x-ray in routine autopsies can settle this matter, and studies of this nature are at present being carried out in Baltimore. Needless to say, similar studies should be undertaken in widely different parts of the country, in order that a representative survey may be possible.

In order to determine the mortality in the in-

fected portion of the population at each age period it is necessary to be able to compare the total deaths from tuberculosis in the entire population at a given age period with the number of infected persons in that age period. In view of the above circumstances it is obviously impossible to pretend to deal with any degree of accuracy with the question of the country's "average" incidence of infection at the different age periods. One can only form an individual impression of the matter from a study of the available urban and rural tuberculin surveys, making allowances for the circumstances discussed; and it is hardly to be expected that there will be any general agreement among the individual impressions so formed. It is such an impression, and no more than that, that is given in Table II. The estimate of the incidence of the infection for each age period has been made as conservative as has seemed compatible with present-day information, and it is probably too low in certain instances. In the older age groups we still have to do with individuals who have had to pass through the period of high exposure risk of the latter part of the last and the early part of the present century, and we cannot expect the incidence of infection in those individuals to reflect as well the more recent lowering of exposure risk.

While the figures in Table II relating to the proportion of infected persons in the population at each age period are admittedly based upon data that leave much to be desired, they nevertheless provide at least a relative view of the situation as it exists today, and it is important to make an attempt to view it from this particular standpoint. Certainly, any correction of the figures for the incidence of infection in any of the age periods within limits that, in either direction, are within range of probability, would not alter appreciably the general trend that the figures express. The figures showing the mortality rate of the infected portion of the population are markedly different from the ordinary mortality rates of the total population, and they bring out more clearly than do the latter figures the following facts which have been recognized by clinicians and students of the epidemiology of tuberculosis:

1. That tuberculosis is most fatal during the first year of life;

2. That it is much less dangerous, but still markedly so during the succeeding several years;

3. That the period between five years and puberty is a strikingly "safe" period, during which the mortality from the disease decreases in spite of the fact that the incidence of infection increases. In this period of life the tuberculosis mortality rate reaches its lowest point.

4. That following the age of puberty there occurs a sharp increase in the death-hazard among those infected.

5. That the increase in the tuberculosis mortality-hazard continues steadily into adult life, reaching a peak in the middle twenties, after which it continues at an elevated level throughout the remainder of the life span, but with variations that depend upon sex, occupation and economic conditions.

6. That in old age there occurs a second peak of mortality-hazard.

From the above facts it is clear, then, that by far the most dangerous age period in which to be infected, from the standpoint of the chance of succumbing during that age period, is that of the first five years of life, and most particularly during the first year; and that by far the safest period is that between five years and puberty. From puberty onward the chance of dying if infected increases rapidly until it reaches a peak, the precise age period of which is inconstant in the total population and may be different for each sex at different periods of time. The mortality rate among the infected is always high in old age, but it may be lower than the first adult peak. How are these age peculiarities to be explained, and what relation, if any, do they bear to age-determined differences in native resistance?

Factors Influencing the High Mortality in Infancy

Regarding the extraordinarily high mortality among those who become infected during the first year of life, it is altogether probable that this is due in part to the fact that since infants cannot move about to court infection they are ordinarily exposed either to heavy and continued infection (phthisical member of the household; contaminated milk, in localities in which bovine tuberculosis is prevalent) or to none at all. This explanation was suggested long ago by Römer,[46] and it is a reasonable one. In addition, it may be suggested that since

malnutrition affects resistance to tuberculosis adversely at all ages, the frequency of nutritional disturbances in infancy may play a rôle in favoring progressive infection in this period. In infancy, as is well known, malnutrition frequently results from conditions other than an insufficient supply of food in the home. High atmospheric temperature, artificial feeding, and acute infections of even slight degree, such as otitis media, are factors which often precipitate a diarrhea that prevents the proper assimilation of food, with consequent malnutrition not infrequently of severe degree. After the first year, debilitating diarrhea occurs less frequently as a complication of these conditions. It is not altogether improbable, therefore, that the greater frequency of malnutrition during the first year may influence to some degree the chance of development of progressive tuberculosis among those who become infected during this period of life.

But these factors of dosage of bacilli and liability to malnutrition do not dispose of the possibility that, in addition, the native resistance of the healthy infant may be lower than that of the older child or adult. Is there any reason to believe that this may be the case?

There is not at present any actual *proof* that the infant has a lower native resistance to tuberculosis than have older individuals. Obviously, it is practically impossible to obtain direct and controlled evidence regarding the degree of native resistance in the human being, for the only way in which the effectiveness of the mechanism of immunity can be accurately determined is by observing the result of a standardized test infection. Neither the clinical nor the pathological aspects of the accidentally acquired disease can help us here, for none of the variables, including the important one of dosage, are controlled.

If we turn to animal experiment for an answer to the question we find that while it has often been demonstrated clearly that young animals are more susceptible to many acute infections than are adult animals, the several experiments which have so far been carried out on tuberculosis have failed to show any convincing differences between the resistance of young and older animals. It may be fairly said, however, that none of the few recorded experiments on this subject are sufficiently satisfying to be regarded as at all conclusive.

Nevertheless, there is evidence from a different direction which, it has seemed to me,[45] can profitably be applied to the problem under consideration, and which renders it altogether likely that the native resistance of the infant to tuberculosis may be lower than that of the older individual. It is essential to bear clearly in mind the fact that any consideration of *native* immunity in a chronic disease involves, inescapably, a consideration of *acquired* immunity. In an acute infection which rapidly runs its course to a fatal termination, native immunity can be studied uncomplicated by acquired immunity, although even here this is true only when an infecting dose is chosen which will not permit survival for more than a day or two. Even in an acute infection, antibody-formation will be initiated as soon as the bacteria have multiplied to numbers sufficient to liberate an appreciable amount of antigen. It is well known, for example, that antibody-formation is often demonstrable a few days after the onset of lobar pneumonia in the human being. When protective antibody has begun to appear, acquired resistance has, of course, already entered the picture. In a chronic infection, in which the bacteria multiply in the body for weeks and months, it is clear that acquired resistance resulting from the infection itself will always have developed to some degree before the disease has run its course. This is strikingly true of tuberculosis. There is unassailable evidence that during the course of primary infection, in both the human being and the experimental animal, acquired resistance usually appears to a very definite degree, even in the case of infections that result fatally. The degree to which acquired resistance develops during infection, and the rapidity of its appearance, are important factors in the progress of the disease; and in many cases in the human being this factor of acquired resistance undoubtedly plays a dominant rôle in determining whether the infection will be restrained and arrested or whether it will progress to a fatal termination. In tuberculosis, therefore, it is essential to consider whether an observed degree of resistance to a primary infection is due chiefly to natively existing elements of immunity, or to circumstances that influence the degree to which acquired immunity develops following infection, and the rapidity with which it makes its appearance. Since this is the case, it is obvious that if the mechanism for devel-

oping acquired immunity were less efficient in infancy than in later life, the infant would unfailingly be less able to resist infection than the older child or the adult. Is there, then, any evidence that this situation actually exists?

Up to the present no satisfactorily controlled experiments dealing with the comparative ability of very young and older animals to develop acquired resistance to the tubercle bacillus have been carried out. There is, nevertheless, important evidence that the immunity response of human infants and very young animals to other bacteria and antigens is much less efficient than that of older individuals of the same species. Freund,[20] Kligler and Olitzki[29] and others have shown that very young animals cannot form antibodies to bacteria, bacterial toxins or foreign proteins nearly so effectively as older animals. This is true of birds as well as of mammals; and it is likewise true of the human being. It has been shown by Halber and his collaborators[23] and others that the human infant is deficient in the ability to form agglutinins in comparison with older children; and Ramon and his collaborators[35] and others have shown that the infant is distinctly less able to form diphtheria antitoxin than is the adult. Davies[17] found that infants in the first year of life failed to produce protective antibody in response to the injection of a pneumococcal antigen that was highly effective in stimulating the formation of protective antibody in older individuals, and Dr. Lloyd Felton, of our department, in a recently completed study, has had the same experience.

In connection with the evidence that infants cannot form antibody as effectively as older individuals, it may be stated that we have recently shown experimentally that the acute splenic tumor of bacterial infections represents a reaction to foreign antigens, and can be readily produced by introducing into the tissues foreign protein, whether of bacterial or non-bacterial origin.[43] It is of interest, therefore, that in infants acute splenic tumor rarely becomes so well developed during infection as it does in adults.

The fact that infants are relatively deficient in the ability to form protective antibodies as compared with adults has an important bearing upon the problem before us; for regardless of the lack of absolute parallelism between antibody titre in tuberculosis as measured by present *in vitro* tests, and resistance to infection as measured by the body's ability to restrain the growth and spread of the bacilli, it is altogether likely that antibody-formation plays an important rôle in immunity to tuberculosis, as it does in immunity to other infections, even though the rôle that it plays in tuberculosis is not yet manifest in all of its relations. It must be remembered that there is no strict and constant parallelism between the serum antibody titre and resistance to infection even in the case of infections in which antibody is well known to play a highly important rôle in a defense. Time does not permit me to enter into a discussion of the function of antibody in resistance to tuberculosis. Here, I wish only to recall to you the fact that infants and young animals have been shown to be natively deficient in the ability to develop acquired immunity and to produce protective antibodies of every type so far investigated, and to point out the reasons for believing that a deficiency of this nature can play an important rôle in determining the well recognized greater susceptibility of the infant to primary tuberculous infection.

It is of interest in this connection that the deficiency in antibody-formation has been found to be particularly striking in infants under six months of age, and Brailey,[10] in the out-patient clinic of the Johns Hopkins Hospital, has found that the mortality from tuberculosis was more than twice as high in infants known to have been infected during the first six months of life as in those whose infection was first discovered between the ages of six months and two years.

Until more evidence is accumulated, we cannot speak with absolute certainty of the rôle that specific age susceptibility may play in the higher tuberculosis mortality rate of infected infants. It is, however, difficult to believe that the infant, with a deficient immunity-producing mechanism, can be natively as resistant to infection as the older child or adult with their more effective immunity mechanism; for in tuberculosis, the rapidity with which an effective degree of acquired resistance develops following infection plays a very important rôle in determining the outcome of a primary infection. Indeed, the well known fact that other infections (e.g., whooping cough, measles, chicken-pox, scarlet fever, diphtheria, pneumococcal, staphylococcal infections, et cetera) are much more fatal in young infants than in older

children, is, in itself, evidence that the native ability of the infant to resist infections in general is deficient (Table III).

TABLE III

Figures for the Last U. S. Census Year (1930)

Age	Deaths Per 100,000	
	Combined Infections	Lobar Pneumonia
0-4	255	56
5-14	47	8
15-24	106	15
25-34	129	23
35-44	126	32
45-54	142	56
55-64	165	90
65-74	223	166

With no intent to disparage the investigation of the possibility of protective immunization by means of BCG or vaccines made of killed bacilli, which most assuredly should be studied until their potentialities and limitations are soundly established, it may nevertheless be pointed out that in administering these immunizing agents to new-born infants, as is ordinarily practiced, they are being applied to subjects who, in the light of all available evidence, have far less power of reacting to immunizing antigens than have individuals at any other period of life. This should be taken into consideration not only in regard to the dosage and the period of immunization, but also in drawing conclusions as to the immunizing power of these vaccines from the results obtained in newborn infants. Used at a later period their efficacy would, in all probability, be much greater.

One final point deserves comment in relation to the matter under discussion. For a long period of time the high mortality of infants with *clinical* tuberculosis led to the universal belief that infection in infancy was practically invariably fatal. More recent follow-up studies of tuberculin-positive infants have shown plainly that this is not the case, and this point has been stressed by Myers[32] and others. However, even in the literature of recent years one may still encounter the statement that the newly-born infant is completely devoid of resistance. Gottstein,[22] in his recent excellent monograph on the epidemiology of tuberculosis, states that at least 80 per cent of all infants infected in the first year of life die of the disease. There are enough studies at present to make it clear that this is far from the case. In a recent follow-up study, Brailey,[10] in the Johns Hopkins Clinic, found that of sixty-six infants who became tuberculin-positive during the first year of life, two-thirds were alive and well at the end of the five years. Had it not been for a large admixture of negro infants in the series the survival rate would undoubtedly have been higher, for 82 per cent of the white infants survived the five-year period as contrasted with only 57 per cent of the negroes.

The Lübeck disaster of 1930 was, itself, highly instructive in this connection. In that unfortunate episode, as is well known, 251 newborn infants who were to have received prophylactic doses of the avirulent BCG bacillus, by mouth, were given by error cultures that were contaminated with virulent human type bacilli. Seventy-two of these children died with extensive tuberculosis within the first year, after which time there were no more deaths from tuberculosis. At the end of four years, when an extensive and minute official report was prepared,[18] it was found that 71 per cent of all of these children who had been infected with presumably large doses of virulent bacilli in the first few days of life were alive with no clinically active lesions, though the presence of arrested calcified lesions, often extraordinary in extent, was demonstrable in most of them. It is, therefore, obvious that it is by no means true that the infant is "completely devoid of resistance." On the contrary, in spite of the very high mortality among infected infants as compared with older individuals, and while there are very good reasons, given above, for believing that the native resistance of the infant is decidedly lower than that of the older child, a large majority of those infected in infancy are able to resist the infection.

Factors Influencing the Mortality Rate Between One and Five Years of Age

During the second year of life the external influences which act in infancy to favor a high death rate among those who become infected with the tubercle bacillus are still operative to some degree. The free excursion of the child into the outside world is still restricted and, as in the case of the infant, though to a lesser degree than during the first year, the most frequent source of infection will still be a phthisi-

cal member of the household or contaminated milk, with the opportunity for heavy and repeated infection inherent in these sources. However, the more independent locomotion of the child at this age increases somewhat its chances of acquiring slight first infections, particularly among the poorer classes. Nutritional disturbances due to diarrhea are less frequent than during the first year but are still fairly common and may serve to depress resistance in a portion of those who become infected with the tubercle bacillus. On the other hand, the ability to develop immune antibodies is distinctly higher in the second year than during the first six months of life, though not yet quite so well developed as in later childhood. These various factors all tend to bring it about that the mortality among those infected during the second year, though still high, is nevertheless much lower than that among those infected during the first year. In Brailey's study mentioned above,[10] the mortality of children who were first found to be tuberculin-positive in their second year was far lower than those in whom infection was discovered during the first six months of life.

After the second year of life the death rate of those who become infected falls markedly. It is reasonable to believe that this is due, in part at least, to the fact that the ability to move freely outside the home is accompanied by the opportunity for acquiring single, slight infections which can be well resisted, in contrast to the situation that obtains during the first two years. In addition, it is pertinent to point out that children between two and five years of age have a decidedly greater ability to form immune antibodies than have infants.[23]

Factors Contributing to the Low Mortality Rate Between Five Years and Puberty

The tuberculosis mortality rate among the infected population in the decade between five years and puberty is markedly lower than that in any other decade of the life span (Table II). The reasons for the low death rate in this period are certainly not all clearly understood at present, but there are at least several circumstances which may be regarded as playing a rôle in this direction.

In the first place, while there is ample evidence from tuberculin tests and autopsy studies that free movement in the outside world during this period is accompanied by a great increase in primary infections, far fewer of these infections produce progressive, fatal disease than in infancy. We may assume, therefore, that a smaller percentage of the infections acquired during this decade are dependent upon heavy and continued exposure in the home, and that a much larger percentage represent the results of single, chance contacts in the outside world leading to slight infections which can be successfully resisted.

This decade is the one during which the individual, exposed freely to contact with the outside world, is most protected against the vicissitudes of life. These are years during which most children are protected in the home and in school, and during which they are, in general, spared from the cares, stresses, strains, debilitating influences and occupational hazards of later life. They have ample time for invigorating play out of doors, and have little to interfere with needed rest or regular and sufficient sleep. Many of the known factors which tend to depress resistance to tuberculosis are, therefore, in abeyance during this decade.

In addition, there is very good evidence that during this period of life the mechanism for developing acquired resistance (so-called "serological maturity") becomes fully established. It was pointed out above that infants and very young animals have a deficient immunity mechanism, and it is interesting to note that at the various periods of life there is a definite correlation between the titre of natural agglutinins, as exemplified by the blood groups, and the power to form antibodies against bacteria and their products. Thus, the new-born infant's deficient antibody-producing power is paralleled by the fact that the isoagglutinins that determine the blood groups are rarely present at birth. In general, the isoagglutinin titre is quite low and in some instances still zero between six months and one year of age; from one to two years, parallel with the increase in antibody-producing power, the isoagglutinin titre rises; and it reaches its height precisely during the period under present discussion, namely, between five and ten years of age.[51] There is no evidence that after this period of life any further increase occurs either in isoagglutinin titre or in immune antibody-forming power.

While there are probably other and as yet undetermined factors, it is reasonable to believe that the above circumstances play a significant

rôle in determining the lower tuberculosis mortality rate during this period of life, which is one of amazing safety as regards most infections, as can be readily seen in Table III. The careful study of the reasons for these marked differences in the mortality from various infections in the different age periods is clearly of the greatest importance for preventive medicine and public health.

Factors Influencing the Rise in Mortality Rate in Adolescence

The close relationship between the age at which the tuberculosis mortality curve begins to rise sharply and the period at which the puberty readjustments of the body take place, suggests at once that the state of pubescence may be accompanied by a depression in resistance to the infection, and that we are faced here with an age-period determined level of resistance. While no absolute proof of this exists at present there are circumstances which render it altogether probable.

In the first place, while the mortality rise at puberty and during adolescence can be accounted for partly by the fact that the freer excursion into the outside world at this period is accompanied by an increase in the opportunities for contact with open cases, it is perfectly clear that this factor alone is insufficient to account for the phenomenon. The increase in mortality far outstrips the increase in infection, and this is true regardless of what tuberculin surveys are used for the estimation of the incidence of infection. Furthermore, we have already seen that in the period between five years and puberty a great increase in incidence of infection is actually accompanied by a decrease in mortality—a fact which stresses the importance of factors other than mere infection incidence in the determination of the relative mortality rate of the different periods of life.

That a certain amount of active tuberculosis appearing at this period represents the evolution of infections acquired earlier in life cannot be questioned, but there is no reason for believing that this increment is great enough to account for the observed abrupt mortality rise unless we assume at the same time that resistance becomes depressed at this period, and so permits a greater number of infections to undergo progression than would have done so had resistance not flagged.

For a better understanding of the level of native resistance at the different periods of life after childhood, we need to know much more about the ultimate fate of those who become infected for the first time at each age period. Superficial studies of this matter, which ignore factors such as family contact, economic status, etc., can be very misleading. In time, the careful, long-period method of individual family study of the type now being carried out in various cities will provide invaluable information regarding the question. In relation to the matter before us, we may cite a study carried out by Opie and McPhedran[39] on persons living in contact with open tuberculosis and followed for a period of ten to fourteen years after the beginning of exposure. Of those first exposed between birth and nine years of age, 9.9 per cent developed clinical tuberculosis; but of those first exposed between ten and fourteen years of age, 20 per cent developed the disease. In this particular study, exposure to familial infection in the unstable period immediately preceding and at the time of puberty was twice as dangerous as was exposure prior or subsequent to this period.

It may further be noted that while the tuberculosis mortality-rise following the low mortality period of childhood is marked in males, it occurs at a somewhat earlier age and is more pronounced in females. In females, the puberty alterations likewise occur earlier and are more profound than in males. Since there is no significant difference between the incidence of infection in males and females at this period of life these facts, in themselves, are highly suggestive that the state of pubescence plays a rôle in altering the resistance of the individual.

Suggestive evidence of the relation of pubescence to resistance is also provided by clinical and pathological experience. From the clinical side it has long been recognized that the period of pubescence is accompanied by a tendency to the exacerbation of latent lesions and the more rapid progression of active ones, and that this danger tends to be more pronounced in the female. On the pathological side it is familiar that progressive lesions of reinfection which develop at this period of life frequently have characteristics which are not encountered in typical white adult reinfections—features which indicate a higher degree of resistance than that seen in progressive first infections of childhood,

but a lower degree of resistance than that in adult reinfections. It is not uncommon, for example, to find in this age-period progressive apical lesions quite like those that are characteristic of adult tuberculosis, though often with rather more prominent caseation and rather less prominent fibrosis; but associated with this type of pulmonary lesion there may be enlarged, caseous peribronchial lymph nodes—a finding that is foreign to typical adult tuberculosis, but is the rule in the progressive tuberculosis of the non-immunized child. In most instances the enlarged lymph nodes are not completely caseous, as they so frequently are in progressive tuberculosis of the young child, but show instead rather large areas of caseation embedded in non-necrotic node tissue. It may be recalled that the adult negro has a tendency to develop precisely this type of the disease on reinfection, and there is very good evidence, which I have assembled elsewhere[45] and which time prevents reviewing here, that the negro's level of native resistance is definitely lower than that of the white, and that dosage and living conditions are altogether inadequate to explain the differences in disease in the two races.

In precisely what manner pubescence acts to influence resistance to tuberculosis, as it apparently does, is at present obscure. The problem hardly lends itself to direct experimental investigation, for the period of pubescence in laboratory animals is of such brief duration. In the attempt to eliminate sexual factors, several investigators[9, 13, 16, 31] have studied the effects of tuberculous infection in castrated animals, but the results have been contradictory.

Approaching the problem from the opposite angle, Vercesi and Merenda[52] and Repetti[42] found that an excess of the female hormone had no effect upon native resistance to tuberculosis in experimental animals; and Dr. L. A. Gray and Dr. C. B. Brack, in our laboratory, have recently shown that acquired resistance is likewise unaffected in animals kept continually in a state of hyperoestrinism. Furthermore, Gray and Brack, in carefully controlled experiments, have so far been unable to confirm the recent report of Steinbach and Klein[49] that antuitrin increases resistance to the experimental disease.

These experiments, of course, demonstrate no more than the failure of an excess of these two particular hormones to affect resistance under the experimental conditions. They neither reproduce the state of pubescence, nor invalidate the view that resistance in the human being is altered at this period of bodily readjustment.

In summary, the sharp rise in mortality that follows the childhood period of relative safety and continues into adult life is accompanied by clinical and pathological evidences of deficient resistance, and is associated with the following circumstances: (1) a progressive increase in the incidence of infection; (2) apparently a specific adverse effect of the state of pubescence on resistance; (3) the beginning of exposure to the stresses and strains associated with the struggle for existance and with childbearing. That other less evident factors may be operative cannot be denied. The most earnest study should be devoted to an elucidation of the factors which influence the development of progressive tuberculosis at this time of life, for the precise reasons for the disastrous effects observed during this period, and later in life as a result of infection at this period, are still for the most part obscure, and the problem is one not only of extraordinary theoretical interest, but of the utmost importance from the standpoint of human welfare.

The Relative Degree of Native Immunity in Adult Life

Following adolescence the tuberculosis mortality rate continues to rise steadily into adult life. The age period at which the peak of the rising curve is reached varies in different places and at different times, but except in communities where economic conditions and industrial hazards are particularly bad, the mortality peak is ordinarily reached in the middle twenties, and at a somewhat earlier age in the female than in the male.

The high mortality rate in the middle twenties is due in part to the rising incidence of infection, but the rate of increase in mortality definitely outstrips the rate of increase in infection-incidence. Other factors, therefore, undoubtedly play a dominant rôle in determining the rise in mortality rate at this period of life. The effects of general and specific occupational hazards, childbearing and the care of a family, and the pressure of the stresses and strains of the struggle for existence are now in full play. In addition, there is no doubt that many cases of tuberculosis having their inception during the suscept-

ible period of adolescence reach a fatal termination in young adult life and so add to the number of fatalities in this period.

Time does not permit me to enter into a discussion of the highly important problems involved in the effect of these various factors upon resistance to tuberculosis. Little is known of the manner in which most of them lower resistance. Even deleterious factors as familiar as malnutrition and physical exhaustion exert their adverse effects in a manner that is still almost completely obscure; and this is likewise true of those factors which at present can be expressed only in rather vague terms such as "over-stress and strain," and "the run-down state"; terms which, however unscientific, nevertheless express very real hazards in the body's struggle to hold a tuberculous infection in check.

I believe that there can be little doubt that childbearing plays a definite rôle in influencing the female mortality rate in the general population. Without questioning the fact that the danger of childbearing may be reduced to a minimum for many tuberculous women *if adequate care is provided before and after labor,* as the studies of Jennings, Mariette and Litzenberg[28] and of others plainly show, it is nevertheless beyond question that childbearing may be attended by a variety of circumstances which can affect tuberculosis adversely if adequate rest and care are *not* assured—and certainly they are not assured in the case of most tuberculous women who become pregnant. Among these adverse conditions I need only mention the physical exertion of carrying the fetus about in the latter months of pregnancy in the performance of the usual household tasks; the exhausting strain of labor; the loss of nutritive materials to the fetus and to the nursing infant, particularly in undernourished women; and the effort and broken sleep involved in caring for the infant after it is born, while the mother is still below par physically. All of these conditions contain factors that are well known to affect tuberculosis adversely, and it may be pointed out that the curve of female tuberculosis mortality bears an interesting relation to the frequency of childbirths at the different ages. At the end of the active reproductive period the female tuberculosis mortality falls sharply below that of the male. I have recently made an analysis of the relation of the female tuberculosis mortality to the birth rate and to certain other factors in the individual states of the Union, and, while other factors undoubtedly are highly important, it is at least interesting that there is a definite correlation between the birth rate among women past 30 and the length of the period during which the female tuberculosis mortality remains above that of the male in the individual states. When it is realized that each year in the United States approximately one out of every ten females between the ages of fifteen and thirty become pregnant, the opportunity for pregnancy to coincide with and to exert its deleterious effects upon tuberculosis in the female becomes impressively evident.

I cannot enter further into the various external factors that influence the development of tuberculsis in adult life but we must, for a moment, consider the question of the level of native resistance in young and middle aged adults, for this is a matter of considerable theoretical and practical import.

There are those who maintain that the previously uninfected adult is more susceptible to tuberculosis than is the child, and that it is dangerous, therefore, to adopt measures that will tend to postpone infection until adult life, particularly since an earlier resisted infection may confer some degree of acquired resistance upon the otherwise highly susceptible adult. Aschoff[3], for example, pleading this view, writes:

"We must, however, remember that with the prevention of the primary infection in childhood the adult is sent forth into life unprotected against this disease, which will then attack him with infinitely greater virulence than the usual familial infection, so to speak, in infancy."

This view that the adult has a lower native resistance than the child has many adherents. It has been based upon two facts: (1) that the tuberculosis mortality rate of young adults is much higher than that of young school children; and (2) that the adults of primitive African peoples in regions previously free from tuberculosis have developed a rapidly progressing type of disease with a very high mortality rate when tuberculosis was first introduced among them. The fear has therefore been entertained that if primary infection in childhood be prevented in our own communities, individuals who become infected in later life will fall victim to a similar devastating form of the dsease because they will lack the protection conferred by the acquired resistance that results from childhood primary infection.

In my opinion, there is no sound foundation for that view. In the first place, in transferring the observations on primitive races to civilized whites, no account is taken of the important evidence, to which I have already referred, that the native resistance of the negro is lower than that of the white race which has passed through centuries of contact with the tubercle bacillus. I have discussed our uncertainty regarding the significance of a negative tuberculin test, and it is a very real uncertainty; but, unless all present-day tuberculin surveys are completely misleading, there must now be a large number of individuals in the population who are being infected for the first time in adult life, and if white adults are really as susceptible as are the adults of primitive races we should at present be encountering on all sides cases of fulminant, primitive type tuberculosis in young white adults. In even the relatively small body of Senegalese troops brought into contact with tuberculosis apparently for the first time during the World War (only 5 per cent were tuberculin positive), devastating, rapidly progressing tuberculosis with caseation of regional lymph nodes and widespread generalization was soon impressively evident.[8] In the great group of tuberculin negative white adults at the present time, on the contrary, the development of this type of tuberculosis is extremely rare, and there is no evidence whatever to indicate that cases of this sort are any more frequent in adults than would be expected as a result of primary infection in a similar number of school children. Finally, it should be noted that there are no observations demonstrating that when tuberculosis is first introduced among natives living under primitive conditions the adults are any more severely affected than are the children.

In brief, the observations on tuberculosis in primitive peoples provides no justification whatever for assuming that the previously uninfected adult, whether white or negro, is any more susceptible, natively, than is the child of the same race.

Regarding the argument that the higher tuberculosis mortality among adults is evidence that adult *native* resistance is lower than that of children of school age, it is hardly necessary to point out that such a deduction is unwarranted, for it neglects entirely the important extraneous factors mentioned above which act to depress resistance in many adults, and from which the child is spared. In the face of such complicating influences, simple mortality rates provide no trustworthy gauge of the comparative degree of native resistance in adult and child.

If there is no acceptable evidence that adults have less native resistance than have children of primary school age, there is, on the other hand, no valid evidence that they are natively *more* resistant to primary infection, as some have assumed. This view that children have less resistance than adults has arisen partly from the failure to separate the highly susceptible first several years of life from the much more resistant primary school age, and partly from the observed tendency of progressive primary infection in childhood to spread throughout the body, in contrast to the more effective localization of the disease in adults. It neglects, however, the influence of resistance in the adult acquired by previous infection.

At present we possess insufficient information to permit us to speak with certainty about the relative level of resistance in previously uninfected adults as compared with children of the same race, and we shall remain unable to speak with accuracy about this important matter until we have more certain information regarding the frequency of *arrested* primary infection in adults, and the clinical and pathological manifestations of *progressive* primary disease in adults. I tend to believe, however, that the information that we do possess indicates that there is no significant difference between the child of primary school age and the healthy adult in native ability to resist a primary infection. The higher mortality from tuberculosis in adult life appears to be referrable to circumstances which depress resistance rather than to an innate, age-determined deficiency in native resistance. The influence which these external conditions exert upon tuberculosis mortality becomes particularly apparent in the fourth decade, for at this period the male tuberculosis mortality rate continues at a high level, whereas the female rate declines; and in parallel fashion, the industrial hazards to which males are exposed continue in full force, whereas the reproductive activity of females declines. Furthermore, the death rate of males at this period tends to be decidedly higher in urban and industrial centers than in rural communities—a tendency that is not shared by the females living under the same economic conditions, but largely

spared from the laboring hazards of the male (Table IV).

TABLE IV. DEATHS FROM TUBERCULOSIS

Per 100,000 White Individuals 30-35 Years of Age. 1932.

	Males	Females
Predominantly Rural States	62.6	73
Predominantly Urban States	86.2	75

Now even though there is at present no reason for believing that the normal adult has a lower *native* resistance than the child, we must not be misled into believing that infection carries no more risk for young adults in general than for children, for there is very definite evidence that it does. I do not think that any of the studies so far made which purport to show that primary infection carries no more of a hazard for young adults than for school children are sufficiently representative or extensive enough to permit us to accept that view. This is one of the situations upon which the figures for the mortality rate of the *infected* portion of the population throw important light, for they show clearly that the death rate among infected young adults is much higher than that of infected children of primary school age. Since the death rate of infected young adults is much higher than that of infected children it is obvious that *on the average* it is more dangerous to be an infected young adult than to be infected in the safe period of childhood. This is doubtless due in large part to the fact that the adverse circumstances discussed above, from which the child is ordinarily spared, often conspire to thwart the protective action of native and acquired resistance in adults. Even though native resistance, when unhampered, may be quite as good in adults as in children, since many more young adults are exposed to the conditions that affect tuberculosis adversely than are children of primary school age, it is reasonable to expect that primary infection in adult life will develop into progressive disease more frequently than in childhood.

It cannot with propriety be argued that the lower mortality rate of children as contrasted with that of adults is due to an inherent benignity of primary infection as contrasted with the malignity of reinfection, as some would have us believe.[34] Those who claim that primary infection is harmless and reinfection disastrous apparently limit their gaze to the examples of well resisted primary infections and to devastating reinfections. Certainly, they appear to ignore the many devastating primary infections so familiar in childhood, and they likewise gloss over the tremendous number of perfectly benign reinfections encountered in adults—the familiar, completely arrested apical scars of reinfection found so commonly at autopsy in individuals bearing older, calcified primary lesions. The truth, of course, is that the overwhelming majority of all tuberculous infections, whether primary or secondary, pursue a perfectly benign course to healing and permanent arrest, and there is no acceptable evidence whatever that reinfection is any more dangerous than primary infection, providing the dosage and the bodily vigor of the individual are the same in both instances. On the contrary, the entirety of the experimental and pathological evidence that we possess teaches us that, other things remaining the same, reinfection is decidedly less dangerous than primary infection.

In regard to the effects of hypersensitivity, in spite of the many assertions about its protective rôle, no one has yet brought forth proof of any sort that hypersensitivity is necessary for any of the protective effects of immunity. Our own numerous experimental studies of the matter, which I have reviewed in another place[44] and into which I cannot enter here, together with the subsequent similar investigations of Siegl,[48] Birkhaug,[6] Clawson,[24] Branch and Enders,[11] Higginbotham[26] and others, have demonstrated plainly that hypersensitivity is not necessary for any of the manifestations of immunity; and it has been known since the time of Koch that the hypersensitive state is responsible for exaggerated tissue destruction at sites where many bacilli are present. It does not at all follow, however, that the hypersensitivity produced by a primary infection "sets the stage" for devastating disease of reinfection, as some maintain.[34] I think that it is important in these matters to keep the known facts strictly where they belong. Reinfection is always instituted by only a relatively few bacilli, and a few bacilli provoke only a negligible immediate tissue damage even in the hypersensitive body. Serious damage from hypersensitivity becomes evident in reinfection only after a sufficient time has elapsed to permit the bacilli to multiply to large numbers; and it must

be remembered that after a similar lapse of time following the entry of the bacilli of even a primary infection, hypersensitivity will be just as highly developed. The amount of damage done by hypersensitivity, whether in primary or in reinfection, depends upon the degree to which the bacilli proliferate after reaching the tissues. If it is true that chronic phthisis occurs only in those who bear an earlier primary lesion, it is no less true that the acute, devastating, "childhood type" of progressive disease, with rapid local necrosis and caseation, and marked tendency to generalization occurs, in civilized races, only in those who have *not* had a previous primary infection.

The important and complex problem of the advantages and disadvantages conferred by a primary infection is bound up inextricably with the moot question whether adult tuberculosis results predominantly from exogenous or from endogenous reinfection. If phthisis is exogenous in origin, and rarely arises from activation of a primary lesion, as Opie[37] and many others believe, then it is obvious that a primary, arrested, immunizing infection could be no liability, and would be of great service in protecting against further infection from without, even though the protection were not always an effective one. If, on the other hand, adult tuberculosis is always the result of the lighting up of primary infections years after their establishment, as Fishberg[19] and others believe, then a primary infection would entail a large element of liability; though even in this case it would not necessarily be altogether disadvantageous, for if progressive tuberculosis can no longer be acquired from without, once a primary lesion has been established, then individuals with primary leisons would at least be protected against the danger of progressive infection acquired through contact.

The truth in all probability, lies in a midposition between these extreme views. There are probably many cases in which tuberculosis arises from the escape of bacilli from latent lesions of primary infection; many cases in which reinfection from without leads to progressive disease in individuals in whom the resistance conferred by a primary infection has become depressed by adverse conditions; and many cases in which the immunizing power of a permanently arrested primary lesion serves to protect the individual from further contact infection. There is now a great body of unassailable experimental and pathological evidence that infection does confer a very decided degree of resistance to reinfection, and it is without question true that the overwhelming majority of individuals who develop a primary lesion arrest the infection successfully and never develop progressive disease thereafter throughout their lives. That the resistance conferred by an arrested infection fluctuates under various influences, and is not effective in all cases in preventing the later development of progressive disease is, of course, perfectly obvious; and until we learn, if ever we shall, whether or not primary infection occurring in adult life would progress to a fatal termination more frequently than adults now develop fatal reinfection, statements purporting to define the virtues or the vices of primary infection can be no more than individual guesses.

In expressing my own belief that a primary infection does exert an immunizing effect which may be very valuable in many individual cases, I should like to stress the fact that there is no incompatability whatever between this view and the belief that all individuals should avoid spontaneous and uncontrolled infection as far as is reasonably practicable; for although the immunizing effect of a primary infection is a fact which can be demonstrated experimentally with the greatest of ease, in spontaneous human infection we can neither regulate the size nor the time of the immunizing dose, nor can we preserve all infected individuals from the external influences that act to rob them of their resistance while they still carry bacilli in their arrested lesions. Those who regard a primary infection as only a liability often seek to imply that all who recognize that infection does confer some resistance to reinfection are in favor of rushing every child into exposure to infection in order that the protective primary complex may be obtained as soon as possible. Of course this is in no sense the case. There must be few, if any, experienced students of tuberculosis today, whatever their beliefs about the primary complex, who favor any other course than that of protecting all persons from infection as far as is reasonably practicable.

Resistance in Old Age

I must devote a few remaining moments to the peculiarities of tuberculosis in the final period

of life. After sixty, the tuberculosis death rate tends to rise sharply, though in communities with an excessively high death rate in earlier adult life this tendency may be masked.

TABLE V. FREQUENCY OF MILIARY TUBERCULOSIS IN THE AGED

Race	Age	Cases of Pulmonary Tuberculosis	Miliary Tuberculosis		Enlarged Caseous Nodes	
			No.	%	No.	%
White	25-50	71	3	4.0	1	1.4
White	60 and over	46	9	19.5	3	6.5
Negro	25-50	86	14	16.3	17	19.7

Certainly, there is no question here of increased exposure to infection as a cause of the rise in mortality rate. On the contrary, the aged tend to withdraw from active contact with the world. A rising mortality rate in the face of diminished exposure to infection implies, in itself, the presence of factors that depress resistance, but is there, in addition, any clinical or pathological evidence that resistance is depressed?

In the aged, tuberculosis often tends to progress with strikingly little in the way of symptoms aside from the cough which, in itself, is often not severe. The disease is therefore frequently unsuspected, even when well advanced and with abundant bacilli in the sputum. A tuberculous grandparent with "chronic bronchitis" to which no attention had been paid, has often been found on investigation to have been the source of fatal tuberculous infection for children living in the same house. This peculiarity of the disease in old age makes it of great importance to investigate carefully the reason for a persistent but otherwise symptomless cough in the aged, particularly if they are in intimate contact with children.

I think that it is probable that the rather symptomless course is due in no small measure to the circumstance that not only do the aged engage in less physical exertion than do younger adults, but even in their normal state they are much more easily fatigued, and the contrast between the degree of fatigability in health and that after the onset of tuberculosis is much less noticeable than in younger age periods.

The fact that, clinically, tuberculosis may run a chronic course in the aged and may be borne with less manifest symptoms than are usual in earlier years has led to the frequent statement that the disease is more benign at this period than in other periods of adult life. The high mortality rate hardly substantiates that view, and there is, in addition to the high mortality rate, some evidence from the pathological side that the resistance of the aged often tends to be less effective than in earlier adult life. Since the better the resistance the greater is the ability to localize the process, it is of interest that there are indications that the aged more often fail to immobilize their bacilli and to localize their lesions than do younger adults. Thus, Taubert,[50] Oppenheim and LeCoz[40] and Braun[12] have commented upon the frequency of fatal miliary tuberculosis in old age. Dr. R. H. Follis, Jr., and I have recently studied a series of consecutive autopsies on cases of progressive pulmonary tuberculosis from this standpoint. The results are presented in Table V, where it will be seen that the frequency of miliary tuberculosis in the old age group was much higher than that at other periods of adult life in the white race, approximating that in the natively less resistant adult negro. The series here presented is a small one, and does not pretend to fix a mathematical percentage incidence for general application. Together with the observations of the above mentioned investigators, however, it does serve to indicate plainly that miliary tuberculosis tends to be a much more frequent complication of pulmonary tuberculosis in old age than at any other period of adult life. Enlargement and caseation of regional lymph nodes, another evidence of deficient resistance, was likewise somewhat more frequent in our old age group, but decidedly less frequent than in the negro adult. Both Braun[12] and Taubert[50] comment on the occurrence of caseation of lymph nodes in old age—an event of great rarity in earlier adult life in the white.

More extended studies of the pathology of tuberculosis in advanced years of age is highly desirable. The available evidence, however, together with the rising death rate in the absence of increased exposure, serves to indicate that the aged have a lower degree of resistance than have the middle-aged. Precisely what the factors are that may be responsible for a decline in resistance in old age is not definitely known, but there are a number of circumstances which might well be operative in this direction. Old persons ordinarily remain indoors much more than younger adults; loss of teeth and of appetite not so infrequently result in varying degrees of malnutrition; diabetes, which appears to exert an unfavorable effect upon resistance to tuberculosis, becomes much more prevalent in old age. In the last U. S. mortality reports there were twenty-five deaths from diabetes per hundred thousand individuals in the forty-five to fifty-five year age period; eighty-seven deaths in the fifty-five to sixty-five year age period; and 177 in the sixty-five to seventy-five year age period. While factors such as these may contribute to the lowering of resistance in old age, they are certainly not the only ones concerned. There are reasons for believing that, in addition, specific though imperfectly understood bodily alterations associated with senility itself may act to impair the body's defence against infection.

In the first place, the lowering of resistance at this period of life is not peculiar to tuberculosis, but is evident in the case of other infections, of so widely different a character as dysentery, erysipelas and pneumonia (Table III). The susceptibility of old persons to pneumonia is familiar even to the layman.

It is probable that physical and mechanical bodily alterations attendant upon senility, such as enfeebled circulation and senile tissue alterations (*e.g.*, atrophy of the epidermis, senile emphysema), may be partly responsible for the more ready establishment of certain infections in certain tissues in old persons. In addition, and more important, a generalized lowered functional capacity of the organs and tissues characterizes senility, and there is no reason to doubt that the immunity mechanism shares in this general decline. In this connection it is important to point out that in very old age the isoagglutinin titre tends to decline to a level approximating in feebleness that present in infancy.[51] The parallelism between the isoagglutinin titre and the ability to form protective antibodies against bacteria and their products was pointed out above, and it is not surprising therefore that it has been established that persons of advanced age are decidely deficient in the ability to form antibodies against bacterial products in comparison with younger adults.

In this connection, it may also be recalled that there is much evidence that the lymphoid tissue is concerned in some way in resistance to infection in tuberculosis and in other bacterial diseases. The rôle of the lymphoid tissue in resistance cannot be discussed here, but I may recall as evidence of that rôle the fact that in animals raised from birth in a strictly sterile bacteria-free environment, the most striking deviation from the "normal" is an extraordinary inconspicuousness of the lymphoid tissue of the entire body;[21] and, on the other hand, the fact that marked proliferation of the lymphoid tissue in both the spleen (acute splenic tumor) and the regional lymph nodes occurs not only during infection, but also, as we have recently shown,[48] during antibody formation induced by even non-bacterial antigens. It is pertinent, therefore, that in old age there occurs a marked atrophy of the spleen and other lymphoid tissue, and that lymphoid proliferation during infections tends to be less conspicuous than at younger age periods.

The peculiarities of susceptibility and resistance at the various age periods, and the manner in which external factors act to alter resistance, constitute perhaps the most important problems in tuberculosis today, not only from a theoretical but, indeed, from a highly practical standpoint; and they deserve the most serious and intensive investigation. In this review of the general outlines of the problem, I have sought chiefly to stress the narrow limits of our present information, rather than to attempt to provide a series of comfortable, theoretical explanations for these complex and incompletely understood phenomena.

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THE ROENTGENOGRAPHY OF PULMONARY TUBERCULOSIS*

With a New Method for Group Surveys

HOLLIS E. POTTER, M.D.

Chicago, Illinois

AS WE gather here today to discuss certain x-ray aspects of pulmonary tuberculosis let us pause for a moment in memory of our mutual and beloved friend, Dr. Russell D. Carman, in whose honor this hour has been set aside. I presume I knew Russell Carman rather intimately before most of you. I knew him best in the years before he came to Minnesota and in those years I can assure you he was quite as interested in the x-ray diagnosis of pulmonary disease as he later became in gastro-intestinal lesions. I may say quite truly that I gained quite a bit of inspiration from his early work on pleurisy and tuberculosis of the lungs and if he were here today I am sure he would heartily approve of spending this hour on the subject of tuberculosis.

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I am sure he would agree with me when I say with no reservations that in all the special fields of medicine where our poor attempts at x-ray diagnosis have gained foothold there is no disease in which we are able to render a more decisive and more valuable service than in the handling of adult pulmonary tuberculosis. Russell Carman and I were active in an era before 1910 during which the average clinician hooted the idea that significant tuberculous lesions could be fairly demonstrated by x-rays in a case where the more classical symptoms and signs were absent. This was the day of the so-called tuberculosis specialist whose very livelihood depended on a public recognition of his superhuman skill in physical diagnosis. He could not afford to recognize any method which would tend to amplify, replace, or debase his special attainments. Fortunately for the human race the specialists of this character are now either dead or very few in number. The most dependable tuberculosis workers of today are free to admit that most early pulmonary tuberculosis should be seen and not heard.

In fact it was not until some of our foremost clinical workers in the tuberculosis field incorporated the x-ray into their own routine practice, checked it carefully against other tangible factors in the diagnosis and followed up their results in an open minded manner that the x-ray method became widely accepted, so that it is now considered the one most important factor in the diagnosis. In this connection, I cannot too strongly express my gratitude for the work done and reported by Dr. Lawrason Brown and his associates at Saranac. It is true that the technic of the old days produced results that were far less convincing than are the brilliant sharp films of today, but the widespread acceptance of the x-ray method has been brought about quite as much by the study and educational work of clinicians and roentgenologists as by the outstanding technical improvements.

As we admit, therefore, that x-rays are rather widely used in general practice and most lavishly used in hospitals and sanatoria, what valuable message might I succeed in bringing you today? What great lesson has the medical world yet to learn about x-rays in relation to tuberculosis? My answer is that too few of the medical men yet understand the low percentage of early cases that are really diagnosed in general practice. One authority states that in a hundred consecutive chest cases where the diagnosis of tuberculosis is correct, less than 5 per cent are discovered in an early stage, less than 15 per cent are discovered at a moderately advanced stage and more than three-fourths are far advanced. Such a startling percentage of advanced cases at first discovery is most often to be explained by the lack of symptoms on the part of the patient sufficient to make him call on his doctor. The balance are either unrecognized by his doctor or sympathetically minimized until the pathologic process gives outspoken signs and symptoms. The insidious onset of so many of these cases demands that if 25 to 40 per cent are discovered early it must be done by some widespread survey in which the doctor goes to the people rather than waiting for the people to come to the doctor. Somewhere our system is wrong and medical practice and medical ethics must be modified to meet the facts. My message then is obviously to encourage some proper system of group surveys and to insist on a more widespread use of x-rays in private work. Personally, I cannot anticipate the discovery of an outstanding majority of these cases in a minimal stage because a real percentage of them are serious from the start and could never be classified as minimal or benign.

I will skip the old controversial question as to whether tuberculosis can be shown earlier by x-rays or by some other method except to express a firm belief that by x-rays the parenchymal lesions can be shown, if not identified, in more than 95 per cent of the cases. Roentgenologists are often criticized for venturing any opinion as to the identity of tuberculosis as shown on x-ray films and severely censured when trying to estimate its probable activity. Regarding the identity there may often be a reasonable doubt. When the lesions are simple and possess characters more or less typical for tuberculosis, I describe them as "tuberculoid" in type and leave it for the clinician and the future to determine whether actually "tuberculous." Regarding questions of activity, chronicity and healing I would maintain that the competent roentgenologist can contribute most valuable information on these points. Frequently, when the state of activity is indeterminate from the study of a single set of films the true condition may be learned from films made after a short period of time. He who can see no difference in character between a frankly active and a near-healed

lesion is not in a position to criticize another who in the light of considerable experience ventures a guarded opinion on one of the intermediate stages.

All things considered, I would mention about ten diagnostic aspects of work in adult pulmonary tuberculosis in which x-rays may be found most helpful.

1. In the negative findings, or determining the absence of a significant lesion.
2. In determining the presence and extent of involvement.
3. In recognizing the probable identity of the lesions in a majority of the cases.
4. In the differential diagnosis.
5. In recognizing the general pathologic form of the disease as an aid in its classification.
6. In recognizing evidences of activity, chronicity, and healing.
7. In the recognition of cavities.
8. As an aid in prognosis.
9. As a guide in determining and following up the surgical procedures.
10. In recognizing evidences of unfavorable advance, dissemination or complications.

Let us, now for the moment, turn back the chest wall and observe some of the basic facts regarding tuberculosis. We find that pathologically there are four main types of the disease, each having its own prognostic implications, but that in many advanced cases the lesions of various types are found together in the same person. At the onset the pathologic type is determined as a resultant between two opposing forces. On the one hand the invading force is measured by the number and virulence of the tubercle bacilli. Opposed to this is the resistance of the invaded host. We find that the architectural pattern of the lesions tends to conform to the mechanics of whatever portion of the lung is invaded, whether a whole lobe, a sub-lobar division, a single lobule or a single acinus.

In the simple or exudative type a minor focus of tuberculosis is completely surrounded and overshadowed by a diffuse homogeneous exudate, the so-called peri-focal reaction or collateral inflammation. On x-ray films it gives a diffuse homogeneous shadow like pneumonia. Only at a later period may further films disclose its tuberculous character by showing a small mottled and nodular residue after resorption of the reactive exudate.

The exudative-productive type is also relatively benign. Its scattered lesions for a time show a melted homogeneous appearance at periphery as from peri-focal exudate, but later, upon clearing, a more resistant nodular central zone appears which remains for some time before complete healing. These productive or proliferative features distinguish it from the exudative type. Upon complete healing it leaves but slight scar either linear or nodular. In these simple forms the intensity of the process does not reach the stage of real necrosis, and cavity formation.

Much more serious is the third type often called the caseous-pneumonic type. In this type more or less massive necrosis does occur and if the patient survives the first onslaught, caseation, liquefaction, evacuation and cavitation follow in due order. In fact, necrosis is its outstanding feature whether this be a necrosis of a whole lobe as in the form called acute pneumonic phthisis or a necrosis involving individual scattered lobules as in the form called acute bronchopneumonic phthisis. The caseation and cavity formation in these cases account for the condition which results in the prolonged or lifetime disability seen in those sub-types known as chronic ulcerative and chronic fibro-ulcerative tuberculosis. These cavity cases fill our clinics and sanatoria. These call for our mechanical and surgical handling.

In the first stages of caseous-pneumonic tuberculosis the density conditions are uniform throughout the involved area so that x-ray appearances may quite simulate the simple exudative type. In the course of a short time, however, when caseation, liquefaction, and evacuation have taken place, a central clear zone indicates the presence and general features of cavity. Gradually the peri-focal exudate may be resorbed and the external portion of the single or multiple cavities become well defined. Delayed absorption and atelectasis are not uncommon in the portions distal to the cavity.

The fourth general type is known as chronic proliferative tuberculosis. It is the result of a long series of super-infecting doses over a long period, seldom accompanied by any show of peri-focal exudate and mainly visible in the form of discrete linear or nodular scars. Starting often in the apex, the lowermost lesions may show diffuse borders testifying to their more recent activity.

No one who gets this bird's-eye view of the

pathology can fail to appreciate the seriousness of the caseous-pneumonic form and no one can fail to recognize the outstanding importance of the necrosis and cavitation sequence. The cavity is perhaps the key lesion upon which prognosis and therapy so largely depend. The early cavity is ragged at margin, irregular in form and tends to lie in the center of a mass shadow of more or less homogeneous density. The early detection of cavity is difficult but important because collapse therapy may then be instituted before adhesions are formed and before a resistant cavity wall is developed. Cavities larger than a cherry seldom heal spontaneously, since they lie in an area of negative pressure, and a valve-trap mechanism in the bronchus may even result in their distention and enlargement. It seems futile to attempt a classification of adult pulmonary tuberculosis without recognizing the cavity as the key lesion.

X-ray interpretation of tuberculous chest lesions is best conducted by one quite familiar with their various pathologic forms in the many and various stages of activity, chronicity and healing, but his ability will depend most particularly upon a vast experience in observing the x-ray findings alongside the clinical state of patients throughout that entire period of time required for their recovery or their death. This experience is greatly amplified by post-mortems on the fatal cases he has studied during life, but in the post-mortem he must not be confused by the pronounced terminal changes which were no part of the picture until the end. He learns to recognize consciously or unconsciously certain shadow structure criteria which are fairly characteristic though not pathognomonic of the disease. He observes the number, size and distribution of the lesions; their outline form and density; the character of their margin; their internal pattern of structure; and their relationship to other pulmonary structures. Certain combinations of these topographic, density and outline form characters are so often repeated in his experience that they come to have important meaning in respect to the kind as well as the degree of pathologic activity.

Topographically the novice who recognizes the single rule that primary adult reinfections are to be found above the hilum is much more often right than wrong. Our older conception that these changes were oftenest in the apex has been broadened to include the subclavicular region and particularly the shoulder periphery. Cavities which represent the climax of the invading process are far up, far back, and far out in more than 95 per cent of cases. Primary reinfections, whether exogenous or endogenous, are rare in the base of the white man's chest and probably less rare in the colored.

Dunham taught us to consider certain of these simple upper lung field lesions in terms of a fan whose handle lies at the hilum and which then spreads out toward the upper periphery as the invaded lobules enlarge. In many others, however, one fails to get the complete fan form but simply sees a large number of more or less discrete nodular deposits, commonly called apical or sub-clavicular infiltrations. In an especially allergic individual the field of involvement may for a time give the impression of a simple pneumonia of lobular or sub-lobar size because of the diffuse over-shadow cast by the exudate.

In a more severe case the involved area is homogeneous and denser until after evacuation of a liquefied area at the center, when our first sign of cavity is noted. Areas peripheral to the cavity may be largely resorbed or may remain in shadow. When patches of clearing occur on the side toward the hilum they must not be misinterpreted as cavities although they present somewhat similar appearance on a single film.

In the secondary reinfections and spread of the disease, new fan-like areas may be seen on the opposite side in apex, mid-lung field or base which often look quite similar to the first upper lesion. In the more advanced caseous-pneumonic cases with multiple cavities and lesions of every age intermingled or superimposed, the picture may become too complex for detailed analysis of each individual lesion.

The roentgenologist is justified in making inference of favorable resolution and healing when exudates become absorbed and the residual nodes shrink down over a period of time to a small nodular or linear form. Larger nodes that persist are eyed with suspicion because of the experience that caseous areas do not always evacuate but are sometimes encapsulated, and may undergo a breakdown at any favorable time. By the same token lesions which show discrete linear or small nodular characters over a longer time may be considered as "arrested," or, finally, as "apparently healed."

From the foregoing statements one can readily see that information obtained from films made at first discovery of tuberculosis is greatly amplified by any subsequent films which reveal a forward or backward trend in the disease. Made from time to time at intervals depending on the activity of the case they aid greatly in prognosis and in a way provide a graphic pathologic history of the disease.

My time is rather too short to point out the weak aspects of the x-ray in detecting tuberculosis but I wish to focus your attention on one peculiar paradoxical situation in which the tubercle bacilli are microscopically apparent in the sputum yet the x-rays show no pulmonary changes. I mean real radiographs and plenty of them on one day. Whether you are a conservative or a liberal you have to look this paradox in the face. It has been explained by pathologists in the last few years by the fact that occasionally a caseous lymph gland ulcerates directly into a bronchus and gives the positive sputum findings. The x-ray examination gives negative findings because on that day there was no pulmonary lesion, the bacilli coming from the gland.

Radiographs then made in a month may show a positive lesion of typical character at some point in the lung. We can only explain this as a dissemination from the gland through the bronchi into the lung similar to the dissemination from a cavity, and we may be thankful that such cases are so rare as to change our accuracy less than 1 per cent.

A very common mistake in the past has been to interpret incorrectly the ordinary prominent linear structures proceeding downward from the hilum as tuberculosis when the upper lung fields were clear. The term "peribronchial tuberculosis" was coined to designate this type of the disease and it was not until the pathologist declared there was no such type and clinicians found it did not progress or change with the years that the term was discarded and the finding discounted.

One outstanding weakness in the x-ray system is the absence of information we can get regarding the chain of lymph glands which lie about the trachea and bronchi, and so often harbor sizable areas of highly infected caseous material. While these encapsulated foci seldom break down and directly infect the adjacent lung areas, they nevertheless act as reservoirs of infection which may be transferred elsewhere by the blood stream. It is probably only fair, when we emphasize so strongly the value of x-rays in detecting tiny lesions in the parenchymal portions of the lung, that we as freely admit our great limitations in detecting the inside structure and true nature of these all-important tracheo-bronchial lymph nodes.

In the next few moments, I wish to present for your consideration and criticism a series of experiments carried out in the laboratories of the General Electric X-ray Company at Chicago. I wish to emphasize that I did not personally conduct these experiments but acted in an advisory capacity. It is through the courtesy of their president that I am now able to make this first public mention of the work. When entirely completed an account of this work will undoubtedly find its way into the proper technical and medical prints.

The experiments consist of new attempts to photograph the fluoroscopic image directly from the screen. Almost since the discovery of x-rays men in various countries have attempted this with various poor degrees of success. Of late years they have tried to make moving pictures of the heart, lungs and stomach for teaching purposes or even for diagnosis. Our efforts were limited to obtaining the finest possible single miniatures of the chest hoping they would still be large enough and of such excellent quality that they could be used in place of the large, bulky and more expensive films now used. We think we have overcome many of the past difficulties in a very fair way.

Heretofore, the first great obstacle in obtaining brilliant and valuable miniatures from the fluorescent screen has been a limitation in speed. The capacity of generators and the capacity of tubes has been enormously increased but not enough to compensate for the limited brilliancy of the fluorescent screen, the speed of available lenses and the speed of such available photographic film as might be considered adaptable.

The first step was to obtain the most rapid screen possible. The ordinary green fluorescent screen was laid aside and a brilliant blue-violet fluorazure screen made of particularly large crystals of calcium fluoride was substituted. Without the usual blue covering material intended to reduce lag, this screen as developed by a competent manufacturer increased the speed seven-fold

when used together with a film especially sensitive to blue and violet.

Using this screen, we then tested out all the very high speed films in the world's market. The tests were made with an f 1.5 lens which would cover one frame of a 35 mm. movie film. A rotating anode tube receiving 400 ma. at proper voltage was found to deliver through the average chest at four feet sufficient x-rays to fully expose certain of the films in a tenth of a second. It may sound peculiar, but the film which showed the greatest speed and best working qualities was no other than our common everyday x-ray film. Many of us do not know that this film is critically sensitive to the particular color values emitted from this fluorazure screen.

But the diminutive 35 mm. size was obviously too small for direct diagnostic reading and all attempts to enlarge these films to a three or four inch square size brought out so much obnoxious grain that they were considered of no practical value.

We next concentrated on the lens problem, trying to find a lens of sufficient speed that would cover a larger film without subsequent enlargement. Tests on an f 2.0 lens that would cover a two-inch square film showed that a chest exposure could be obtained in about two-tenths of a second but the films look a little starved and were too small for large film substitutes. Their enlargements, however, gave much less grain prominence.

Using the same power and distance factors, an f 3.5 lens which would cover a four-by-five film was then used. This gave rather good miniatures in half a second. They seemed quite large enough for direct reading and showed no appreciable grain. The films, however, often showed movement in the lower pulmonary structures just as half-second films do in the larger sizes and it was considered necessary to consult lens manufacturers about a lens of f 1.5 speed that would cover a three or four-inch square film.

At first, we were told that no lens of this character had ever been constructed but possibly could be. Shortly, it was learned that one lens of this speed which would cover a three and a quarter-inch square film had been constructed for rapid night photography from aeroplanes and we were extremely fortunate in obtaining a short time loan of this lens to continue the experiments. Naturally, it was a very large lens, having a diameter of about six inches and weighing no less than twenty-six pounds. Now, using the same rapid screen, a rotating anode tube and the same power and distance factors, a series of chest miniatures was then obtained which seem to answer all requirements. They are brilliant, fully exposed in a tenth of a second or less and quite free from grain. We are pleased to submit these films for your inspecition and criticism. Although but three and a fourth inches square they show, with faithfulness, every detail present in standard sized films of the same chests.

A lens of this large size was then immediately ordered and has been recently delivered. It differs from the borrowed lens in that it has a higher light gathering power and is designed to focus the blue-violet light which altogether doubles its efficiency. The next experiment will be to place the equipment in a local tuberculosis sanitarium where a large series of films will be made from pathologic chests to be compared for readability with the standard sized films at hand. These may then be submitted to a group of experts for evaluation.

Should miniature films of this size and quality prove to be an adequate and practical substitute for our present standard sized films in the case-finding program of a tuberculosis survey you will quite agree that the filing and storage problem will be greatly simplified. The material expense for a single film is reduced to about five cents. This means that in a thousand cases the film cost alone will be lowered from about six hundred dollars to about fifty dollars.

THE FOOT AND ANKLE*

Their Discomforts, Deformities and Disabilities

PHILIP LEWIN, M.D.
Chicago, Illinois

I HAVE chosen a subject which is large both anatomically and geographically. I wish I could cover the subject from every practical point of view, including the orthopedic, industrial, surgical, roentgenologic, dermatologic, genito-urinary, obstetric, gynecologic, neurologic, sociologic, economic and arthritic aspects, but that is obviously impossible. I have tried, however, to keep uppermost in my thoughts the function of the foot and ankle, which means their physiologic activity, their usefulness and comfort; in short, their "performance."

It is important to be able to arrive at a fair estimate of percentage of partial or total disability in order that both the patient and the employer be treated fairly.

A man who has had a fracture of the leg, thigh or foot, after weeks of treatment, may appear to have an excellent cosmetic and roentgenographic result, but he says his foot hurts and he can't walk; he doesn't walk and he won't work. I am interested in what can be done to give him a good functional result.

The relation of feet and their defects to other complaints such as backache, sciatic pain, knee pain and hip pain, is sometimes very close and occasionally brilliant results follow correction of foot imbalance. While I feel that the foot condition should not be underestimated, I do not lay too much stress upon this part of the examination, because the local complaint, such as backache and sciatic pain, must be thoroughly investigated, independently.

It would be impractical to consider foot lesions apart from the leg because the functions of the two members are closely associated. Every organ or tissue may react upon the general health, usually by the infectious, glandular or metabolic routes, but the feet, in addition, may react mechanically.

Foot abnormalities may be indicators of disturbances of the general health. Just as the eye specialist may, from an eye examination, suspect a serious lesion of the kidneys, so the orthopedic surgeon may find evidence of disturbances of the general health, which, if thoroughly investigated, may reveal important facts. A doctor's wife consulted me because of a simple metatarsalgia. She had a spastic condition with disturbed skin sensation and some ataxia. I advised a neurological examination, which revealed evidence of a tumor of the spinal cord, which was proved by operation.

The foot cannot be treated as an isolated member, but must be considered a part of the human organism. This is especially true of mechanical disturbances of the feet and legs which are aggravated by constitutional abnormalities such as infections in the teeth, throat, sinuses, ears, glands, chest, stomach and intestines, genito-urinary tract, and disturbances of the circulatory apparatus.

It is possible to judge some of the mental and physical characteristics of an individual by his gait.

An employer when engaging an individual will observe if that person has a springy gait or if he has a slouchy, dull, rigid gait. If one observes a large number of people walk into a room that has a runner of carpet, he will see some trip, proving that many people do not lift but drag their feet.

Shoe fitting is an art that requires years of experience, a proper determination of the type of shoe and a complete stock in order to fit the foot properly. Much progress has been made, through coöperation of shoe manufacturers with the orthopedic profession, in the manufacture of shoes for children and men, but women's shoes are still far from perfect. There is no one brand or type of shoe that is appropriate for every type of foot. Important advances were made in the solution of the static foot problem by the work of The American Posture League which divided feet into straight, inflare and outflare varieties. High heels tend to produce sway-back.

In many of our United States a license is required of every blacksmith who shoes horses, but I want you to show me one state in which

*Read at the annual meeting of the Minnesota State Medical Association, Duluth, Minnesota, June 30, 1938.

the human shoe fitter is required to have any special qualifications.

The chief foot defects are: Congenital defects, deformities and disabilities; acquired deformities and disabilities; diseases of bones, joints, muscles and nerves; traumatic conditions of bones, joints, muscles and nerves; paralytic conditions; circulatory disturbances, and tumors.

Congenital defects include absence of toes, constricting bands, supernumerary toes, syndactylism, congenital hypertrophy, congenital overgrowth of leg and foot, overlapping toes, and bipartite sesamoid bones.

Congenital deformities include various types of talipes.

Acquired deformities may be due to tuberculosis, syphilis, infantile paralysis, spastic paralysis, infections, flat-foot, metatarsal depression, bursitis, hallux valgus and exostoses.

The important traumatic conditions are fracture, dislocation, epiphyseal separation and epiphysitis. Warts, papillomas, corns of both the hard and the soft varieties and most circulatory disturbances are acquired.

Diseases of the foot are chiefly tuberculosis, syphilis, osteomyelitis, epiphysitis or osteochondritis such as Köhler's tarsal scaphoiditis. Freiberg's infraction of the metatarsal head, apophysitis of the os calcis, arthritis due to gonococcus, staphylococcus, streptococcus, metabolic and traumatic causes are common in the foot.

Tumors of the foot are chiefly lipomas, fibromas, osteomas, angiomas, sarcomas, melanomas, and melanoblastomas.

In 1781, Peter Camper, Professor of Medicine in Amsterdam, published a book entitled "A Dissertation on the Best Form of Shoes." According to Bick, it included a detailed anatomic study of the foot and its arches, and illustrated many of the distortions caused by pointed shoe toes, tight shoes, and other defects of the last. James Lowie, an Edinburgh shoemaker, quoted from an English translation as follows: "Shoes which are not adapted to the foot of each individual are defective; and a shoemaker who would excel in his art ought to have an exact knowledge of the diversity of form, more especially if he wishes to prevent corns upon the joints, and between the toes, inflammation of the roots of the nails, especially of the great toes, and painful callosities. . . . He will prevent all these annoyances by giving a proper form to his shoes." Camper, who was a scientist, an anthropologist and an anatomist, virtually introduced the subject of static foot deformity. Following him, LaForest, a Frenchman, wrote a book, and from that period on, increasing studies on foot mechanics appeared.

The importance of foot disabilities other than those causing obvious gross deformity such as club-foot, was not appreciated until 1781, when Camper wrote his memorable Dissertation on the Best Form of Shoes.

The study of the mechanics of human gait offers the only physiological basis for an intelligent approach to the treatment of static foot disorders.

In 1836 the Weber brothers published a volume on the mechanics of locomotion, containing the first serious scientific study of human gait. They stressed the importance of the pendulum action of the lower extremities during locomotion, and described in great anatomic detail the muscular and articular structures involved.

Janssen suggested the study of gait by means of serial pictures, but the first successful application of the method was that of Carlot, in Paris. He made graphic records of the human gait by means of shoes built with rubber soles in which were placed air compression chambers for the heel and forefoot. Carlot published his observations in 1872. Three years later Marey published another volume on locomotion in man and animals in which Carlot's air chambers were also used. Bradford was among the first of the American orthopedic surgeons to study the problem. Muybridge was said to have been the first to use an electric photographic method for recording gait (1925). This has been modified and improved from time to time. The most recent advance in the study of gait has been made by R. Plato Schwartz and his co-workers whose electrobasographic methods of recording gait, described in 1933, has offered refinements in study not previously possible.

Along with the development of methods for recording gait, the study of foot function from the anatomico-physiological viewpoint has proceeded with parallel progress. Duchenne, during his classic investigations on muscle function, was the first to note a specific relationship between muscular imbalance in the leg, and the everted foot. He felt that the most important

factor in locomotion was well coördinated muscle control of the limb and its individual segments. Delpech, the master of French orthopedics, made a similar observation, so that the myogenic etiology of static foot deformity was early impressed upon French students. Toward the end of the nineteenth century, Royal Whitman distinguished between true flat-foot, and a pseudo flat-foot, in which the foot and leg become everted, painful, and, in advanced cases, more or less rigid.

The concept of the "weak foot," flaccid in its early stages and rigid in advanced cases, has almost entirely superseded the older concept of flat-foot.

Against the myogenic theory of static foot deformity has been brought the hypothesis of the stretched plantar or calcaneo-navicular ligaments. According to this hypothesis, the pain and disability of foot dysfunction is due to a gradual elongation of the tarsal ligaments, consequent upon faulty habits in walking and standing, or the use of improper shoes. Keith, however, emphasized what Duchenne had suggested, the fact that the interosseous ligaments are but secondary supports in weight bearing extremities, and are only called into play when the musculature of the part becomes ineffective. He referred to them as the "fatigue structures." As such, he maintained that their being stretched, or elongated by persistent passive strain, must of course presuppose inadequacy of the muscles concerned. The osseous theory of this deformity, which gave to it the popular name of "fallen arches," was based on the assumption, held especially in England, that the bony longitudinal arch of the foot was a true arch with the navicular or head of the astragalus as its keystone. This theory was refuted by the British orthopedists, Golding Bird, Adams, and Walsham, but it is constantly reiterated in the literature, especially in connection with operative methods of treatment. The literature of the nineteenth century contained a tremendous bibliography of books, monographs, theses and papers on the subject of foot deformity, a good proportion of which dealt with flat-foot. However, the work of Whitman and the advent of roentgenography invalidated many of the purely speculative concepts. In 1885, Shaffer described a painful static foot deformity of no specified etiology characterized by a high longitudinal arch, extended proximal phalanges, almost a mild pes cavus, the so-called hollow foot. Although its etiology has never been determined, except for the hypothesis of short shoe-wear, Shaffer thought its pathogenesis to be a contracted tendo achillis. In 1876, T. G. Morton introduced into the literature the term metatarsalgia, a type of foot disability in which severe pain occurred in the region of the metatarsal arch. Morton believed the symptoms to be neuralgic in character, and described pain radiating into one or more toes due to pressure on the digital nerves as they passed between the heads of the metatarsal bones. Goldthwait, in 1894, and Robert Jones, in 1897, demonstrated that this was primarily due to a prolapse of the metatarsal arch. Another lesion giving similar symptoms had previously been described by Breithaupt (1885). This lesion, known variously as marchfoot or *pied force,* was fairly common among soldiers following long marches, and was treated as a strain or sprain until roentgenography disclosed its true pathologic change to be an infraction of a metatarsal bone, in which the fracture is not perceptible until some time after the appearance of symptoms. It resembles to some extent Kümmel's disease in the vertebræ.

To Hugh Owen Thomas, the great Liverpool surgeon, all static deformities of the foot were a problem of joints and ligaments rather than muscles. In the treatment of flat-foot, he introduced the raised and forwardly extended inner border of the heel of the shoe. During the middle of the last century the use of "arches" came into vogue. These "arches" or foot plates act as braces for the bones and ligaments of the longitudinal arch "which has broken down," or, as in the Whitman brace, serves to actively invert the foot, thereby bringing it into normal relationship and relieving the supporting musculo-tendon mechanism of undue strain. There has been a constant controversy between those who advocate rigid plates, and those who advocate non-rigid supports. The spring-arch first appeared rather generally in the literature during the nineties. Any reasonable support in an adult, adjusted with a proper appreciation of the mechanics of the deformity, can become suitable for the particular case. Foot supports have been made from steel, duraluminum and other metals, celluloid, leather, cork, wood and rubber. Thomas said: "It isn't the apparatus, it is the principle underlying its application that is important."

In children, adolescents and young adults, the tendency has been away from rigid supports, and

in favor of exercises aimed at strengthening the involved muscles. Although foot plates are frequently used for temporary assistance, in younger patients many orthopedists feel that the raising of the inner border of the sole is sufficient to invert the calcaneus during the period of exercise or other physical therapy. These exercises are planned to strengthen specifically the anterior and posterior tibial muscles, and in some instances the intrinsic muscles of the foot. It is felt with increasing confidence that, at least in younger patients, such treatment affords an effective cure. Many surgeons vary their methods with the individual patient. Plates, manipulations, and exercises assisted frequently by physical therapy are used interchangeably. The painful foot represents a large proportion of private practice in probably every orthopedist's office. By the time these patients reach the orthopedist, the disability requires far more attention than the simple application of a rigid support.

The rigid or spastic flat-foot presents a difficult problem. To Royal Whitman is due credit for valuable study of this deformity, and the most effective methods of treatment. In such cases, correction by the simple use of foot plates or braces is impossible. Most cases, however can be improved by manipulation under anesthesia, followed by a plaster-of-Paris boot to maintain the over-corrected (inverted) position. After removal of the plaster the foot is stretched daily for a prolonged period of time, and the foot braces are worn as described by Whitman. For the very resistant cases, in which recurrence follows even the most painstaking treatment, operation becomes necessary.

Surgery of the Foot

Bone operations designed to correct deformities of the foot are, because of the highly specialized anatomy of the part, peculiar to themselves and represent a course of development in many instances quite distinct from the general rule of operations applied elsewhere upon the skeleton. Bick recalls that Fabricius Hildanus removed a fractured talus in 1608 to overcome the resulting disability. In 1741, Broglie repeated the procedure in a similar case of long standing with the intent of correcting the deformity. The operation was again performed by Marrigue in 1782, and Desault in 1788. Broca, in 1852, and Lund, in 1872, advocated the removal of the astragalus for local destructive disease, and in 1857 Cock suggested the extirpation of the astragalus, scaphoid, cuneiform and cuboid for the same indication. In 1857, Solly removed the cuboid in an attempt to correct the deformity of club-foot. In 1878, Albert, a Viennese orthopedic surgeon, conceived the idea of employing a stabilizing operation for the relief of paralytic deformities of the foot. In order to accomplish this he adapted his method of arthrodesis to the bones of the tarsus, denuded the articular surfaces of their cartilages, and allowed fusion to occur during a period of immobilization. In the same year, and later in 1888, Golding Bird performed a similar operation, but applied it to severe flat-foot deformity. He removed the navicular, and in some cases also the head of the talus. The earlier case was probably the first occasion in which surgery was used for the correction of flat-foot. In 1884, Ogston performed a talo-navicular arthrodesis, also for flat-foot, by resect the head of the astragalus, and denuding the articular surface of the navicular. He continued this procedure, but later, when necessary, he secured the two bones by an inserted ivory peg. He then sutured the surrounding soft parts, and immobilized the foot. Shortly after this, Stokes advised merely the removal of a wedge from the head and neck of the astragalus. In advanced cases of valgus deformity. Trendelenburg advocated fracturing the tibia and fibula above the ankle joint, permitting union with the foot adducted.

In 1901, Royal Whitman performed the first astragalectomy on a paralytic foot in a case of calcaneus deformity. In this operation he not only extirpated the astragalus, but, by displacing the foot backwards, gained the advantage of a direct line of support from the tibia through the mid-tarsus. It secures excellent stabilization without obliterating motion at any of the tarsal joints; and can be performed in children at any age. In 1908, Jones described a fusion operation for calcaneo-cavus, and later Dunn devised a similar procedure for several types of paralytic foot deformity. Goldthwait, also in 1908, tried the effect of fusing the ankle joint in cases of complete paralysis of the foot. In 1911, Lorthoir reported eight cases in which the astragalus was removed, denuded of cartilage on all sides, and replaced. The intent here was to effect a multiple arthrodesis. In 1913, G. G. Davis, of Philadelphia, described a type of fusion opera-

tion, or arthrodesis, which, unlike those of his contemporaries, involved only the subastragalar joint. Whitman's operation, and the arthrodesing types of operation, have formed the basis for many subsequent modifications since developed by Hoke of Atlanta, Ryerson of Chicago, and others. Hoke's arthrodesis is one of the most important contributions to this subject. According to his technic, the head of the talus is removed, and reshaped to accommodate itself to the deformity. It may be replaced or if advisable left out altogether. The articular surface of the navicular is denuded to allow for subsequent talo-navicular fusion. Secondly, the articular surfaces of the cuboid-calcaneal joint are fused, and lastly the subtalar joint is arthrodesed. Ryerson conceived the idea of constructing a bone ledge at the anterior border of the talus to check dorsiflexion in cases of paralytic pes calcaneus. In addition to these basic procedures, Jones, Garre and Kuttner, Perthes, Schwarz, David, Gill, Putti, Ombredanne, Steindler, Campbel, Zadek, Lambrinudi, Mayer and others have advised numerous modifications and additions to the surgical correction of paralytic or severe static deformities of the foot. Among these operations are Jones' transverse osteotomy of the tarsus, Zadek's wedge osteotomy, Steindler's stripping of the plantar fascia for the correction of cavus, and Campbell's bone block for equinus. This latter has recently been simplified by Wagner. Mayer of New York formerly corrected such deformity entirely by tendon transplantation, but has recently added to his original procedure a modification of Hoke's operation. Gallie, Whitman, and others have likewise devised methods of relieving such deformities by means of muscle-tendon operations, but in general these have not met with the same acceptance as have procedures practiced upon the bones and articulations. In 1921, Soule proposed driving a bone pin through the navicular into the talus in cases of marked valgus deformity. Gleich sawed the calcaneus in an oblique direction and shifted the posterior fragment forward. The non-operative treatment of club-foot is not far different today from what it was during the Hippocratic era. As early as the sixteenth century, corrective braces were used, and these have been modified ever since. Paré, Glisson, Hunter, Venel, and Scarpa have all devised apparatus for this purpose. Theories of etiology have been numerous and variations of therapeutic measures have, to some degree, depended on the contemporary theory in vogue. The possibility of intrauterine mechanical restraint was held by Hippocrates, Scarpa, and Paré. Bessel-Hagen, in 1899, restudied the subject in the human fetus, and came to the same conclusion. Arthur Keith believes that the phylogenetic evolution of the human foot adequately explains the condition of club-foot if one assumes a developmental rest of the fetal foot at an anthropoid stage.

Hugh Owen Thomas advocated the immediate forcible correction of the deformity, to be followed by a retention splint devised to maintain an over-corrected position. For this purpose, he constructed an osteoclast of special design, the "Thomas Wrench." Grattan, of Cork; Bradford, of Boston; and Lorenz, of Vienna, adopted the method in their extensive practices, and also designed similar, though modified, osteoclasts. Lorenz later made use of a padded pyramid over the apex of which he "broke" the deformity. According to Brockman, the French orthopedic surgeon, Guerin, in 1836, was the first to use a plaster bandage to splint the corrected club-foot. However, it was not until twenty years later that plaster-of-Paris was introduced and became popular in the treatment of these cases. A great step forward was made after overcoming considerable resistance, when the advisability of treatment at the earliest possible moment was realized. Until the end of the nineteenth century, treatment was deliberately delayed until early childhood. The practice of correction in early infancy has done more than anything else to solve the problem of club-foot. Zadek and Barnett, who studied a large series of end-results, found that the subcutaneous section of the tendo achillis and posterior capsule of the ankle joint was of additional advantage in certain cases. Failure to correct equinus is a cause of recurrences.

A notable advance was the introduction of operative methods for correction of cases seen in late stages with bone deformity. The use of achillo-tenotomy, as introduced by Stromeyer and others, will be discussed later. Many operations aimed at the correction of the malformation of the tarsus were popular during the nineteenth century. Augustoni and Morestin attempt to improve the position of the foot by removing the astragalus; Championniere removed several bones of the tarsus in addition to the astragalus; Gibney excised only the head

of the astragalus, or in other instances the proximal end of the fifth metatarsal; Muller, Robert Jones, and many others practiced the removal of wedges, cut from almost every conceivable angle, to produce purely mechanical or cosmetic correction of the deformity. In addition, the intra-articular surfaces of almost every tarsal joint, and combination of joints, have been resected and arthrodesed.

In 1892, Bradford wrote: "The literature of the treatment of club-foot is, as a rule, that of unvarying success. It is often as brilliant as an advertising sheet, and yet in practice there is no lack of half-cured or relapsed cases, sufficient evidence that methods of cure are not universally understood. In all methods related to the treatment of club-foot, time and painstaking attention to the details of after-care are probably the most important factors in success.

An important stimulus has been introduced by Kite, of Decatur, Georgia. Severe operations necessarily entail considerable mutilation of the internal architecture of the foot. While such operations may give excellent cosmetic results, they almost invariably leave feet that are more or less permanently or recurrently painful. Kite proposed to first correct the deformity by slow conservative manipulations, without anesthesia. Each small correction is followed by a plaster to hold the new position. After repeated corrections over a period of time he found that the parts were susceptible to remarkable reformation. After maximum correction has been obtained, a period of observation is allowed. If a tendency to recurrence appears, the foot is surgically fused before the deformity appears. Under this method, a simple anthrodesing operation is sufficient to maintain correction, and more extensive surgery is no longer necessary.

The operative experience gained in the treatment of paralytic and congenital foot deformities has been applied to other foot disabilities. Numerous operations have been devised to overcome the malformation of rigid or exaggerated flat-foot, traumatic pes valgus, severe hallux valgus and other distortions. The present ingenuity applied to surgical procedures upon the bones of deformed feet is of temporary utility, since outstanding success follows only the proper early application of methods conceived for the prevention of bone deformity consequent to weight bearing.

Physiology

The physiology of the foot is concerned chiefwith the mechanics of weight-bearing and flexible locomotion. The structure of the foot furnishes spring to the step, which prevents jars to brain, spinal cord and abdominal and pelvic organs. Brown says the functions of the normal foot, which is certainly one of the most marvelous machines in Nature, are: weight-bearing during standing and locomotion, the provision of a spring to reduce jars and assist propulsion during movement, and action as a pivot to assist the turning of the body. There are few movements which do not combine all three of these. These functions do not depend entirely on the foot itself, but on the brain and spinal cord, so that an anatomically intact foot does not insure a perfectly functioning foot. The integrity of structure and function are not identical.

Disturbances of physiology involve mechanical stress and strain on muscles, ligaments and capsules of the bones and joints.

Two bones of great importance are the astragalus and os calcis; the former because it is the mortise bone between the leg and the foot. The astragalus articulates with the tibia, fibula and scaphoid. It articulates with the os calcis in three places. Although it cannot move itself, because it has no muscle attachments, it is subjected to the superincumbent weight of the entire body. The os calci is important because of its attachments for the achilles tendon and plantar fascia. It furnishes the initial bearing surface of the foot as it strikes the ground in walking. The scaphoid and first cuneiform bones owe their importance to the attachments of ligaments, and especially the tendons of the peroneus longus, and the anterior and posterior tibial muscles. The longitudinal arch is composed of the os calcis, astragalus, scaphoid, first and second cuneiforms, first metatarsal and proximal phalanx of the great toe. When a foot is in action it is supported chiefly by muscles, but when standing, chiefly by ligaments. Hoke emphasized the importance of three tendons: those of the anterior and posterior tibials and the flexor hallucis longus.

Terminology

The generic term for foot deformities is "talipes" derived from talus (astragalus) and pes (foot). If the toes are at a lower level than the heel, the term equinus is used; if the heel

is lower than the toes, the term calcaneus is used. In addition to either of these positions, if the foot is rotated on the long axis of the foot, the terms varus and valgus are used.

Inversion of the foot occurs when the inner border is elevated. Eversion occurs when the outer border is elevated. When a foot is inverted, there is a tendency for the fore part of the foot to approach the mid-line of the body, that is, adduction. This movement occurs chiefly at the tarso-metatarsal articulations. With eversion, there is a strong inclination to the opposite movement at these joints, namely abduction. When a foot is inverted and adducted, there is usually an upward and outward rotation of the medial bones of the mid-tarsal region, namely, the scaphoid, and the first and second cuneiform bones. This constitutes supination. If a foot is everted and abducted, the reverse occurs, that is, downward and inward rotation of the medial mid-tarsal bone, producing pronation. A foot that is inverted, adducted and supinated is in varus position, and a foot that is everted, abducted and pronated is in valgus position.

Shoes and Their Modifications

As a general proposition one may say that a shoe should be straight-lasted, round-toed, have a moderate height of heel and a rigid shank. It must be narrow in the heel and through the waist of the foot, but wide through the ball. There is comparatively little difficulty in obtaining proper shaped shoes for children and men; but for girls and women the matter is entirely different. Women are the victims of two things: one is style and the other is the shoe salesman. Women prefer to fit the eye rather than the foot and please the eye rather than their husbands. "There is no shoe too small for an ambitious foot."

Shoes are modified, for the most part, in the regions of the heels, soles, counters, and big toe. The chief modification of the heel is the Thomas heel, which is longer and higher on the inner than the outer border. This compels the individuals to walk over the proper walking angle so that a weight-bearing line dropped from the middle of the patella, bisects the tibia and the astragalus. The chief modification of the sole is the elevation of the outer border where the highest point of the wedge should be under the base of the fifth toe.

Modification of the counter includes the removal of the counter for irritation of the heel; and the prolongation of the counter on the inner border to protect and support the scaphoid, cuneiform I and base of the first metatarsal. Modification in the region of the big toe joint consists in a rigid sole to prevent motion in the big toe joint. This procedure may be beneficial in relieving the pain in cases of osteoarthritis of the big toe joint. The chief modification of the sole is what is known as a metatarsal bar or metatarsal cleat which consists of a strip of leather or rubber secured between the layers of the sole, at a point just behind the heads of the metatarsal bones. The so-called Denver bar is very effective.

Old Shoes

How much a man is like old shoes!
For instance, each a soul may lose.
Both have been tanned, both are made tight
By cobblers. Both get left and right.
Each needs a mate to be complete,
And both are made to go on feet.
They both need healing, they both get sold,
And both in time turn all to mould.
With shoes the last is first; with men
The first shall be the last; and when
The shoes wear out they're mended new;
When men wear out they're men dead, too.
They both are trod upon, and both
Will tread on others, nothing loth,
Both have their ties, and both incline,
When polished, in the world to shine;
And both peg out—Now, would you choose
To be a Man, or be his shoes?—M. C. Dodge.

* * *

Note: Much of the historical material has been derived from Bick, Edgar M.: Source book on orthopædics, Baltimore, Williams and Wilkins, 1937. The author gratefully acknowledges permission to use this source in his paper.

AUTHENTIC BIOGRAPHIC DATA*

MONTE C. PIPER, M.D.

Rochester, Minnesota

THE constitution of the State Medical Association asserts that the purposes of the organization are the promotion of the science and art of medicine, the protection of public health, and the betterment of the medical profession.

The Council of the State Association adopted, last year, the new application blank for membership because sufficient record of the life histories of the members was not being maintained. Mr. Ralph K. Lindop remarks in "The Legal Aspects of Records" that, "it may be safely laid down as a general principle that whenever there is a duty to do, there is also a duty to record the things done." John G. Bowman, Director of the American College of Surgeons, says that, "record means Authentic Evidence" and, as refers to hospitals, "the record department is directly responsible for the reputation of the hospital." Fred G. Carter adds, "Records protect the physician in his practice." Likewise, the Council felt that records would be of value in protecting the reputation of the medical profession.

There is much evidence of record of achievement in the progress of science and teaching but there is no systematic uniformity in recording the progress of the members of the profession as a whole. While a doctor is attending school and applying for licenses, numerous records are made. His qualifications are recorded in an exacting manner but after he has graduated and has become elected to membership in the Medical Association, there is no further uniformity or system of recording his progress and activities. He is turned loose, as it were, to practice his profession with the assurance that he is qualified and, unless he is outstanding in some manner, his identity may be all but lost. True, he is protected by the licensing board of the state and the state journal is sent to his address; his colleagues know of his activities to some degree but authentic evidence or record is no longer maintained.

The old application blank for Association membership contained very little information not included in the records of the licensing board and this new blank is only slightly more comprehensive than the old one, but it is a beginning, at least, for "the betterment of the profession." The new blank is designed to collect further historic and genealogic data and reveal something of the progress of each individual in medicine.

One is struck with wonder that, in the three thousand years of medical organization, there seems to be no evidence of concerted successful recording or compilation of the progress or failure of individual members. It is true that there is a vast amount of information about a few and much information regarding some physicians but there is certainly a paucity of information regarding many. Newspapers and magazine articles form the chief source of recorded data, but the doctor must "break into print" occasionally to be thus recorded. Large newspaper offices maintain very extensive reference libraries formerly called "morgues," some with as many as two million references. The American Medical Association has maintained a library of clippings and other information for thirty-two years. They have name cards with accumulated data concerning every doctor of whom they have ever had record and, now, there are accumulated about a million references. The library is admirably systematized, supervised, and kept alive, but its data come from printed or written reports.

The State Board of Medical Examiners is now keeping clippings and other data that their efficient office staff finds by searching publications. With the new application blank of the State Medical Association, each name is supplied with a large envelope in which all obtainable information will be filed. These, however, are only records of something remarkable enough to be printed or written about. There is no uniformity of purpose of these records except the accumulation of references.

Ramsey County Medical Society has compiled some biographic data and has a very fine album of photographs of many of its members. Hennepin County has photographs of all of its former presidents and attempted, for a time, to keep

*From the Section on Obstetrics and Gynecology, The Mayo Clinic, Rochester, Minnesota. Read before the annual meeting of the Officers of the County Medical Societies of the State, Saint Paul, Feb. 26, 1938.

a rather complete biographic record of all members but it has not been continued. The University of Minnesota Press has recently published "Physicians of The Mayo Clinic and The Mayo Foundation." This new volume contains the photograph and complete biographic and bibliographic data on all Members of the Staff of The Mayo Clinic and Fellows in the Foundation. No doubt, other groups have some system of keeping alive active records, but publications of these systems have not been found. The majority of members of the profession are unrecorded, perhaps throughout life, unless some event in their lives seems of sufficient importance to be "written up."

There is no uniform record of progress. Cities, villages, counties, and states do not attempt to maintain a measurement of the progress of professional men other than tabulations of qualifications. So far as has been ascertained, hospitals do not maintain a personal record of their staff except the professional qualifications and accomplishments of each member, if such pertain to the care of patients. The reputation and success of a hospital depends entirely on the quality of its staff members. One would suppose that hospital managements would be concerned about the health, the civil activities, the recreations and leisures and the families of so important a part of their organization.

The Medical School of the University is starting a five-year follow-up of its graduates to ascertain their successes and the shortcomings of their scholastic training. The General College of the University has made a critical survey of a group of graduates that preceded the depression and a similar group of students who have graduated since the depression to ascertain their attitudes toward the education obtained. This survey was made by use of a very comprehensive and painstakingly prepared questionnaire. It would seem that no better estimate of the usefulness of an education could be obtained than by those who have had an opportunity to apply that education to life.

Sir Richard Livingstone says there is a "threefold function of man: to make a livelihood, to be a citizen, to be a man . . . At present life is so arranged that most of us do our thinking in youth at an age when we are not best fitted for it, and having left the University think, systematically, no more. What wonder that middle life finds so many unaware of recent progress in their own field, unapt for new experiments and ideas, deeply embedded in a rut, while progress waits impatiently for their death and the arrival of the next generation . . . In every point except the economic one adult education has the advantage . . . It is given to students who desire it, who have the mental development to receive it, and have the experience of life to value and interpret it."

There are many members of the doctors' guild who are doing valiant work, are of much influence for progress and good example in their communities, who have the love and respect of those who know them and have success. Of these, there is very little, if any, written record. Such lives should contribute a part historically, for history is the study of change in humanity, the development of human society in space and time.

The historical committee has made diligent effort to assemble facts of medical history in this state over the approximate period of 1850 to 1900, and they have succeeded to a remarkable degree. Those who have undertaken the task must have given freely of effort and time. The records they are able to obtain of the pioneers are written records in some form or other. But a knowledge of others, of whom there is so little written or recorded, has vanished with the passing of the friends and relatives who remembered them.

The new application blank will contain a uniformity of data which will be available as a starting point or a foundation on which may be added further information of the past as well as of the future. It is the desire of the Council that all members of the Association fill in these new blanks as completely as possible. Data other than what is requested in the questions will add much more to their value. Some seven county societies have already completed these blanks in large numbers. Others have voiced objections to filling out another blank and, probably, that objection is largely due to a misunderstanding as to the use that is to be made of these blanks. Previous members are asked to comply, so that uniform biographic data may be obtained of all. Records exist of your training period. Why should there be objection to keeping record of your progress?

This new movement has, as its object, uniformity in recording; it should be dedicated to all of the profession, quoting Dr. Henry E.

Sigerist, "To the unknown doctor, who, in unselfish and inconspicuous activities, fulfils the teaching of the Great Doctors."

The great teachers are conspicuous and there is much record of them but there are great physicians whose contribution to the welfare of their communities should not go unrecorded. Assuming that this foundation is established by collecting the data of the new information blank, why should not the medical association, of which we are members, continue to record a system of progress and build a structure showing advancement on that foundation? It would seem that such a procedure would be of present-day value as revealing cumulative authentic evidence in the future of progressiveness of the profession as a whole.

Such evidence might be obtained by various methods, but the one which suggests itself at present as being the most feasible would be a survey at stated intervals, perhaps once every five years. It would be feasible because all members would participate in personally supplying the desired information. Dr. R. G. Leland, Director of the Bureau of Medical Economics, says, "A knowledge of the competence of the members of the medical profession should be of value primarily to the public—but this knowledge should be compiled by the profession itself."

A committee consisting of the chairmen of several existing committees and including those of medical education and of history together with others interested in the subject could compile a suitable questionnaire or invoice sheet. This committee, probably, would wish to obtain assistance in compiling that form from the medical school and other departments of the University. Such a questionnaire of census could be filled out by individual members with the understanding that personal identity be treated confidentially. Conscientiousness and integrity would be assumed in compilation by each member. It would be a coöperative method and each member would be requested to contribute to its compilation. Such an attempt to keep a record of progress would be a new venture entirely, for there seems to be no published evidence of such an effort previously having been tried or, at least, carried on. Such an investigation might reveal professional achievements, courses of study taken, participation in medical societies, honors attained, articles published, type of medical reading, value of certain journals, attitude toward preventative medicine, maternal and infant welfare, workmen's compensation and contract practices, hospital facilities, coöperation with other doctors, fitness for the chosen field or specialty, personal inspirations or inhibitions, civic activities and rewards, fluctuations in compensation, influence of relief problems, ancestors in the medical world or other geneologic factors influencing ambitions, progress of one's family, children studying or practicing medicine. Likewise, the investigation might reveal general achievements like recommendations of measures to advance the standards of medicine, improvements in medical school curricula by stressing some factors and curtailing others, postgraduate studies of practicing physicians, adult education, evaluation of fitness of some physicians in their field, health of doctors, occupational diseases, hobbies, recreations, trends, illness, and prevalence of hereditary influences on some diseases.

It is a sad commentary when cardiologists show that physicians succumb to hypertensive heart disease and coronary disease more frequently than those of any other vocation. The cumulative strenuousness and unremitting responsibility of the physician's life seem to be taking their toll of doctors. There are probably many other valuable factors which could be worked out. Supposing some such survey had been conducted over the past twenty-five years and included in its scope twenty-five to fifty thousand physicians. There could be evolved from statistical study of such records answers to many of the criticisms which have been aimed at the medical profession by some members of the medical profession and by the social reformers of recent years. The officers of the American Medical Association would, no doubt, welcome such information if it were available.

The success of such a survey or questionnaire would depend on the ease with which the questions could be answered. If they could be answered readily, without too much trouble, most men probably would be willing to fill out the blank. If questions were cumbersome and involved, many probably would defer answering them, and, finally, forget to answer them. But, if it is to be a record of progress, it would have a certain appeal.

Doctors should be qualified to keep records. It is important regarding the care of the patients and should be important to one's own life. When the American College of Surgeons, in 1913, required the records of 100 cases in order to qualify for membership, it afforded stimulus to hospitals and physicians to keep accurate records and these records have been an invaluable stimulus in the furthering of medical studies.

The recording of the individual physician's activities will also be of great aid to future historical committees. Much information of this nature is disappearing as the older generation passes on and it should be collected while it is still available. The historical committee cannot reach it all.

There is an organization which could render very valuable assistance, if it could be prevailed on to undertake the task. Our wives are organized as Women's Auxiliary and, if they would undertake to collect this information, it would be a valuable assistance and, assumedly, an enjoyable project for their activities.

Perhaps some form could be supplied with an individual physician's name and address filled in and this could be allocated to the Auxiliary of the respective county unit. No doubt the historical committee would welcome such assistance.

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NUTRITION IN PREGNANCY*

RUSSELL J. MOE, M.D.

Duluth, Minnesota

IN spite of much valuable laboratory and clinical research on the problem of nutrition in pregnancy, it is only within recent years that we have begun to apply these findings to obstetrical practice. We, as practitioners, have failed to give proper attention to the dietary requirements during pregnancy. In view of the fact that an adequate protective diet is an important part of good prenatal care, it behooves us to give this problem the attention it rightly deserves.

It is an accepted fact that many of the complications and disabilities associated with pregnancy, labor and lactation are due directly or indirectly to improper or inadequate nutrition. This often begins in the early prenatal period, especially with multiparous, overworked women, and with women who are naturally substandard or chronically undernourished. There are still some misconceptions among medical men as to what constitutes the nutritional needs of the pregnant state. In general, this question may be answered by the statement that the mother should be supplied with the various foods necessary for her own metabolism, and in addition, those needed for the growth and development of the fetus.

Foods may be considered under two main types: (1) the "protective" foods, consisting chiefly of those containing "good" protein, minerals and vitamins; (2) the "energy-bearing" foods, such as carbohydrates and fats. The ideal diet includes sufficient "protective" foods to prevent the development of deficiency diseases, as well as the proper proportion of "energy-bearing" foods, to maintain the growth and activity of the body. Actual starvation from lack of sufficient calories is practically unheard of today. The real danger lies in the fact that individuals in the low income group are forced to substitute the lower priced carbohydrates for the higher priced foods containing protein, minerals and vitamins.

Protective Foods

The highly protective foods include milk, cheese, eggs, meat, butter, fresh green vegetables and raw ripe fruit. Sunlight may also be considered an adjunct to the above list, because it generates vitamin D in the organism. The value of milk as a food for pregnant and lactating moth-

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A. Protective Foods:

Food	Amount	Protein	Calcium	Phosphorus	Iron	Iodine	Vitamin A	Vitamin B_1	Vitamin B_2	Vitamin C	Vitamin D	Calories	Remarks
	Grammes				Milligrammes		International Units			International Units			
Milk	1,000	32	1.2	0.9	2.4	0.02—0.05	Rich (1,000-3,000)	Good (50-75)	Rich	Poor	Poor	660	(a) Calculations for lean meat.
Meat (or fish or poultry)	120(a)	22	—	0.3	5.0 / 2(a_1)	—	Poor	Poor (b)	Rich	Poor	None	240	(a_1) One-half calculated as available iron.
Eggs (one)	50	6	—	0.1	1.5	—	Rich (1,000-1,300)	Good (about 15)	Rich	None	25-40	70	(b) Except glands (liver and kidneys) and pork muscle.
Cheese (c)	30	8	0.3	0.2	0.4	—	Rich (800-1,000)	Poor	Good	Poor	Poor	125	(c) Calculated as cheddar cheese.
Green and Leafy Vegetables	100(d)	1	0.1	—	1.2	—	Rich (1,000-1,500)	Good	Good	Poor	None	30	(d) Estimated on basis of ⅓ cabbage, ⅓ lettuce, ⅓ spinach.
Potatoes	250	6	—	0.2	2.0	—	Poor	Good	Good	Good	None	250	
Legumes, Dried	10(e)	2	—	—	0.2	—	Poor	Good	Good	None	None	35	(e) Calculated as beans.
Cod Liver Oil	3.5	—	—	—	—	Richest source	Rich (1,800-3,500)	None	None	None	Rich (about 300)	30	
An available source of Vitamin C (from raw fruits and vegetables)										To yield 250-500			
Total Yield		77	1.6	1.7	10.2	Adequate	Over 5,000	Over 150	Adequate	Over 500	About 300	1,440	

B. Supplementary energy-yielding foods by means of which the individual's energy requirements can be met.

Cereals as needed:													
Highly milled	250(f)	28	—	0.2	2.5			Rich (about 250)				1,000	(f) Calculated as white flour.
or Whole Grain	250(g)	—	0.1	0.9	9.0							1,000	(g) Calculated as whole wheat.
Fats as needed.													
Sugar as needed.													

The estimates are based on data in Sherman's "Chemistry of Food and Nutrition," 4th edition, 1933. The figures for milk are calculated for a content of 3.2% protein and 3.5% fat. The figures for vitamins, however, are converted to international units and must be regarded as rough approximation only.

TABLE I. NUTRITIVE VALUE OF FOODS[4]

Food	"Good" Protein	Minerals	A	B	C	D	
Milk	++	+++	+	+	+ø	+ø	Highly protective foods
Cheese	++	++	+	+	—	—	
E Eggs	++	++	+	++	—	++	
Liver	++	++	+	++	—	+	
E Fat, fish (herring, etc.)	+		+	+	—	++	
Green vegetables	+	+++	+	+	++	—	
Raw fruit		+++	+	+	++	—	
E Butter	—	—	+	—	—	+ø	
Cod liver oil	—	—	+++	—	—	+++	
Yeast	+	+	—	++	—	—	Less protective foods
Meat (muscle)	+	§	—	+	§	—	
Root vegetables, tubers			+*	+	+	—	
Legumes (dry peas)			—	+	—	—	Non-protective foods
E Cereals (whole meal)	+	§	§	+	—	—	
E Cereals (white bread)			—	—	—	—	
E Cereals (polished rice)			—	—	—	—	
E Nuts	§		—	++	—	—	
E Sugar, jam, honey			—	—	—	—	
E Margarine, olive oil and other vegetable oils			—	—	—	—	

E = foods of high energy value
+++ signifies very rich
++ signifies rich
+ signifies present
§ signifies present in traces
— signifies absent
ø signifies in summer
* signifies if yellow in color

ers is well recognized. A committee report of the League of Nations on the relation of nutrition to health states that the use of the milk from cows or other mammals in the diet of the human race is as old as the history of mankind, and during the long ages in which it has been thus used its value has ever been highly esteemed. A land "flowing with milk" was the ideal of pastoral tribes in ancient times, and will still remain the ideal if the balancing of nutrition and health of the people receive due consideration. The report continues with the statement that modern scientific research has entirely confirmed the empirical conclusion drawn from human experience as to the dietary value of milk. Milk, which is designed to afford complete nutrition to the mamalian young, is known to contain all the factors needed for satisfactory nutrition, combined in a suitably proportioned mixture of protein of "good" quality, fat, carbohydrate, mineral salts and vitamins. In this respect, milk is the nearest approach we possess to a perfect and complete food. No other food that can be used as a substitute is known. The administration of calcium in any form or dosage cannot completely replace milk. The patient who will drink one quart of cow's milk daily during pregnancy and lactation will satisfy her calcium and phosphorus requirements in a form which is especially easy of absorption and assimilation. In addition, she will obtain valuable protein food, in the form of lactalbumin and casein, both of which are not only present in large quantities but possess a highly nutritive value. We must also be mindful of the fact that in milk there is no loss of protein by cooking, such as occurs with the protein of muscle meats.

The vitamin content of cow's milk varies with the seasons of the year. However, the reduction of vitamin D in winter milk is easily overcome by the daily administration of two or three teaspoonfuls of cod liver oil or its equivalent. It is neither necessary nor desirable to give large doses of cod liver oil or its concentrates routinely to pregnant women. Vitamins are not a panacea for all the ills that beset women during pregnancy. Just as in all other conditions, judgment must be used in their administration. Naturally, associated fever or vomiting may call for special measures and larger dosages until equilibrium is attained. There is accumulating evidence to the effect that increased ossification of the fetal

skull, leading to a higher incidence of dystocia, may be due to excessive calcium and vitamin therapy.

It should be understood, however, that certain women present more or less chronic deficiences of iron, protein and vitamins; and just as they need large doses of iron so a few may need, temporarily at least, large doses of vitamins. If we simply evaluate the condition of the tongue, the fingernails, in association with determining the presence or absence of free hydrochloric acid in the stomach and the hemoglobin level, we gain a valuable estimate of our patient's dietary efficiency.

Cheese, which may be considered as concentrated milk, contains the "good" protein, as well as the calcium salts and vitamins of milk. Small portions of cheese may well be included in the diet two or three times a week. Butter is a valuable food, because it is composed of the most easily digestible fat, and is an additional source of the fat soluble vitamins A and D.

Eggs are another important source of good protein, as well as valuable minerals and vitamin B. They are usually well tolerated, and may be prepared in a number of ways to entice the individual who will be benefited by them.

While ordinary muscle meat is inferior to milk or eggs in nutritional value, it does serve as an important source of protein and iron. We are all aware that many of our patients are instructed by their lay advisers to eat little or no meat during their pregnancy. The results of these curbstone consultations are undoubtedly reflected in some of the anemias seen during pregnancy. It is estimated that two grams of protein per kilo of body weight are needed by the maternal organism and the growing fetus. The daily requirement of protein for the patient of average weight would therefore be between one hundred and thirty and one hundred and fifty grams. Furthermore, all this should be absorbed. Liver, kidney and sweetbreads have a logical use, since they are rich in minerals and vitamins not found in muscle meats.

Green leafy vegetables and raw ripe fruits are highly acceptable, particularly because of their vitamin A and B content. They also contain the antiscorbutic vitamin C if taken in the uncooked form. The abundance of minerals adds greatly to the value of vegetables and fruits. Calcium is present in oranges, while grapes and apricots are rich in iron.

In many parts of the world it is desirable to complement the vitamin intake, especially during the winter and spring months, by the administration of cod liver oil or other fish liver oils. Some of the vitamins taken by the patient will be lost, however, if she routinely uses mineral oil to overcome constipation. The fat soluble vitamins A and D are soluble in mineral oil.

While a patient may have an adequate intake of vitamins, the constant presence of mineral oil in the bowel may cause that patient to have a deficiency. As a result of the absorption of vitamins by the mineral oil the amount available for metabolism is utilized only in part.

In goitrous regions it is advisable to recommend either the use of iodized salt or two to three minims of Lugol's solution a week.

Energy-bearing Foods

The energy-bearing foods include cereals in their various forms, sugar, potatoes and fats. These foods should be added to the protective foods in a quantity sufficient to satisfy the energy requirements during pregnancy. An analysis of the cereal foods reveals that many of their valuable elements are lost in the process of milling. White flour, for instance, is rich in carbohydrate but lacking in the B vitamins contained in the husk and germ of the grain. There is also a definite reduction in the mineral content of the highly milled grains when the bran and germ are cast off. The accompanying table shows clearly the relatively large amounts of minerals in wheat bran and wheat germ as compared with those in white flour. A finely textured white bread is produced at the expense of these valuable constituents.

It is apparent that there is some variation in the value of the different carbohydrate foods. Sugar and milled cereals predispose to dental disease when introduced to people in remote districts or countries where tooth decay was previously unknown. Contrary to popular belief, potatoes are of distinctly more value than sugar or milled cereals, in that they do not predispose to dental caries. In addition, they are a valuable source of iron, and, according to some authorities, retain a high proportion of their vitamin C content even after cooking. Certainly, the balance of evidence indicates that we are not solv-

TABLE II. MINERAL COMPOSITION BY WEIGHT OF WHEAT AND WHEAT PRODUCTS[7]

	Whole wheat	Wheat flour (white)	Wheat bran	Wheat germ
Potassium ...	0.473	0.115	1.217	0.296
Sodium	0.039	0.060	0.154	0.722
Calcium	0.045	0.020	0.120	0.071
Magnesium ..	0.133	0.018	0.511	0.342
Phosphorus ..	0.423	0.092	1.215	1.050
Chlorine	0.068	0.074	0.090	0.070
Sulphur	0.005	0.177	0.247	0.325
Iron		0.001	0.008	

ing the problem of dental caries by the administration of excessive amounts of calcium and vitamin D. Proper dental hygiene and eating of foods that require more chewing seem to be the factors which promote alveolar circulation and dental metabolism.

Another factor in the dietary management of a pregnant woman is the observation of the weight curve. A woman of normal weight is expected to gain from twenty-five to thirty pounds during her pregnancy, while a woman who is overweight to start with should be expected to gain less than that amount. Conversely, a woman who is underweight may well gain more than thirty pounds. By recording the average weight of the patient before her pregnancy and the weight at each prenatal visit, the physician is readily made aware of any abnormal weight gain, which will indicate one of two conditions: either an abnormally high carbohydrate intake, or an impending toxemia with its disturbed water metabolism.

The size of the fetus apparently is not affected much by the weight gain of the mother. Our present evidence indicates that the mother's metabolic rate may be a more important factor in determining the weight of the baby.

Summary

1. The diet of the expectant mother should include a quart of whole milk daily, to furnish the necessary calcium and phosphorus as well as "good" protein and vitamins.

2. A generous helping of meat is necessary for an adequate protein intake. The lay and medical advice to avoid meat has been very pernicious.

3. Eggs and cheese will furnish additional protein and valuable minerals.

4. Fresh leafy vegetables and raw ripe fruit are necessary for their vitamin and mineral content. The vitamin needs should be determined for each individual.

5. The vitamin content of the diet should be conserved by avoiding the routine use of mineral oil.

6. In goitrous regions small doses of iodine are valuable adjuncts to the dietary.

7. The substitution of coarse cereals and potatoes is to be recommended to replace the highly milled cereals and sugars.

8. Small doses of cod liver oil are of definite value during the winter and spring months.

9. The routine use of large doses of calcium and concentrated vitamins should be condemned.

10. Observation of the patient's weight during pregnancy will indicate excessive gains, as well as give warning of impending complications.

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Discussion

DR. E. C. HARTLEY, Saint Paul, (read in his absence by Dr. V. O. Wilson): Doctor Moe has reviewed concisely the important points to be considered in the nutrition of the expectant mother.

In my discussion I wish to draw your attention to two points which are significant.

First: The subject is one of more importance than would appear to the casual observer. The studies of the Mixed Committee of the League of Nations bear witness to the far-flung bearing which nutrition has on health, on agriculture and on the economic policy of nations. Its more intimate relations to health are the immediate concern of a growing number of publications devoted entirely, or in part, to the complex relationship between nutrition and health.

Second: The importance of nutrition reaches its peak in the pregnant woman. Here the protective and the growth factors in nutrition have their greatest significance. Our point of view here is both absolute and relative. The absolute requirements of the pregnant woman as compared to the non-pregnant woman are summarized in a chart from the League of Nations "Report on the Physiological Bases of Nutrition."

By relative requirements I mean those individual variations which the physician so frequently meets, and which he should recognize so that he may guide the patient in the necessary adjustments in her diet.

Dietary deficiencies in the pregnant woman may be due not only to a failure to eat the proper foods in adequate amounts. It is often due to a failure to utilize such foods after they are eaten. In either case there are usually clinical signs obvious enough to guide the

physician in correcting the deficiency. I agree with Doctor Moe that the indiscriminate use of calcium and vitamin D in pregnancy is neither desirable nor necessary. It is equally true, however, that the calcium requirements of every pregnant or nursing mother cannot be met by the classic dole of one quart of milk daily. The need for extra amounts of calcium is indicated by definite clinical signs. So, also, are the needs for extra amounts of iodine, or of iron.

The protein requirements of the pregnant, and especially the nursing mother, are of great importance. Meat and eggs should be included on an equal plane with milk, and there is no great urgency in curtailing them too drastically at the first sign of toxemia.

The response of individuals to pregnancy, as we all know, is exceedingly variable. This variability extends to their nutritional needs, and we must be ready to recognize this variability and to adjust our patients to such a standard as will be optimum in individual cases.

INFLAMMATORY LESIONS OF THE CERVIX AND VAGINA*

LEE W. BARRY, M.D.
Saint Paul, Minnesota

TO the physician, the different inflammatory lesions of the cervix and vagina are oftentimes of minor importance. This is not the viewpoint of the patient. The resulting pelvic discomfort and especially the leukorrhea drive her from doctor to doctor in search of a cure. The constant vaginal discharge violates her ideals of cleanliness. She longs for the day when she can dispense with douches and the constant wearing of a sanitary napkin. The physician who affects a cure renders a worth-while service by restoring her health and happiness as well as her waning confidence in the medical profession.

The inflammatory lesions of the cervix, which will be considered, are cervicitis and endocervicitis (acute and chronic), the various erosions, cystic changes, lacerations, eversions, ulcerations, polypi and hypertrophy.

Injuries to the cervix during childbirth and gonorrhea are the two greatest causes of cervicitis and endocervicitis. Inflammation of the cervix may be classified as acute, sub-acute and chronic. In acute cervicitis, treatment should be restricted to a minimum, reliance being placed mainly upon cleanliness. Treatment with strong chemical solutions or with a thermal cautery should never be attempted. The cervical canal should not be invaded, because of danger of carrying infection into the uterine cavity with subsequent tubal, ovarian, or peritoneal involvement.

At the present writing, sulfanilamide is popular in the treatment of acute gonorrhea. Orr[13] treated thirty females with sulfanilamide, with cures in 26, or 86.6 per cent, of the cases. No local treatment of any kind was given. For the first four days, eighty grains of sulfanilamide were given in twenty grain doses, every four hours, from 8 a. m. to 8 p. m.; forty grains daily were given for the next four days, and the doses were then reduced to twenty grains daily for the following seven days. The total dosage of sulfanilamide given to each patient was 620 grains during a period of fifteen days. In all the cured cases, smears became negative within two weeks. Many other writers have reported similar results, which would seem to indicate that sulfanilamide is a very valuable drug in the treatment of acute gonorrhea in the adult female.

The use of the Ferry-Corbus filtrate[3] is still an unsettled procedure. The hyperpyrexia of Bierman and Horowitz,[2] Desjardins,[6] Stuhler,[16] et al, has cured gonorrheal cervicitis, in 45 to 86 per cent of the cases, but the treatment is not without danger and requires a corps of well trained attendants to constantly watch the patient while a rectal temperature of 106 to 107 degrees is maintained for four to six hours. To obtain a cure the treatment must be repeated four or five times, at intervals of three to four days, at the end of which time the patient begins to wonder which is worse, the disease or cure.

Just what proportion of acute cervical infections become chronic is difficult of determination. However, it may be stated that practically a third of the women who visit the gynecologist do so because of a chronic endocervicitis.

Chronic cervicitis, endocervicitis, the chronic cervical erosions of whatever variety, and the cervical ectropions, may be treated with 50 per cent phenol, 5 to 30 per cent silver nitrate solution, zinc sulphate, either in a strong solution or by means of a zinc sulphate saturated porous pencil introduced into the cervix. All of the above treatments, result in a fair percentage of cures. Tincture of iodine, mercurochrome, argryol and

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ichthyol have been proved to be practically worthless.

In the last decade the treatment of the above conditions has been fairly well standardized in nearly all the large gynecological clinics. This standard treatment consists in linear cauterization of the cervix with a fine nasal tipped electro-thermal cautery. Incisions are made in the cervix with a cautery tip about one-fourth of an inch apart. The incision is begun in the cervical canal, one-half inch from the internal os, and is prolonged well over the outside of the cervical lip until it reaches the normal vaginal epithelium. If properly performed, one cauterization results in a cure in approximately 80 percent of the cases. Surgical diathermy with its more expensive equipment and more complicated technic gives about the same percentage of cures. After cauterization, the cervix should be observed at weekly intervals for about three months. Cervical stenosis may be prevented by keeping the cervix dilated up to 4 mm. at monthly intervals for one year after cauterization. The first one or two menstrual periods after cauterization may be very profuse, but this rarely ever results in any serious consequences. Cauterization of the cervix is contra-indicated: (1) where there is an acute infection of the cervix; (2) immediately before or immediately following a supra-vaginal hysterectomy; (3) in the presence of an acute or sub-acute salpingitis; (4) during pregnancy or within six weeks following delivery.

Nabothian cysts are best treated by puncturing the cyst with the cautery tip, pressure being exerted until the whole cyst cavity is thoroughly cauterized.

Lacerations of the cervix should not be repaired in the presence of an existing inflammation; too often, the diseased portion of the cervix is rendered inaccessible to treatment as a result of the surgical repair. Cure the cervicitis first and repair the cervix later.

Ulcerations of the cervix are simple, chancroidal, syphilitic, tuberculous, and malignant. Simple ulcers are rather obscure as to their origin and a cure is usually spontaneous without treatment. The chancroidal ulcer, due to Ducrey's bacillus, is usually multiple; the margins are ragged and undermined. Treatment with pure formalin is a specific.

Primary syphilitic ulceration of the cervix occurs more frequently than is generally suspected. The ulcer is round, slightly depressed, and is surrounded by a white wheal-like area at the periphery. Leutic secondaries cause shallow ulcerations of the cervix which are very fleeting in character. They often disappear spontaneously in the course of a week or ten days. Tertiary syphilitic ulceration of the cervix may occur from five to forty years or more after the primary lesion, resulting frequently in a massive sloughing of the cervix and surrounding tissues. Diagnosis is best confirmed by finding the spirochetæ pallida in any of the above lesions. In the presence of the primary and tertiary ulcers the Wassermann reaction is usually negative. If the lesion is syphilitic, constitutional anti-leutic treatment should be instituted at once.

Tuberculosis of the cervix is rare and is usually secondary to tuberculosis elsewhere in the genital tract. The four forms of cervical tuberculosis are: the miliary, ulcerative, papillary, and interstitial. Diagnosis is confirmed by biopsy. Treatment by cautery or surgical removal of the lesion results in a cure in about two-thirds of the cases. Radium and x-ray have been used with considerable success. Many clinicians, however, maintain that in tuberculosis of the cervix panhysterectomy is still the treatment of choice.

A biopsy is indicated in any cervical ulcer which fails to react to treatment. Many ulcers apparently inflammatory in character are proved by the microscope to be malignant. The microscope is many times more accurate than the most accomplished clinician.

Cervical polypi occur in the cervical canal at any age. They usually result from a chronic cervical discharge. Quite frequently they are multiple. When removed, their bases should be cauterized. All polypi should be examined microscopically, as a certain proportion are malignant. The incidence of malignancy increases with the age of the patient. To rule out malignancy, absolutely, it is a good policy to curette the uterus after the removal of a polypus, and have the curettings examined by a competent pathologist.

Hypertrophy of the cervix results from a chronic cystic and interstitial inflammation of the cervix. The cervix may reach enormous proportions, at times almost filling the vagina. Treatment is by electrical conization or surgical

amputation. In conization, one may employ either Hyams'[11] or Crossen's[4] technic. In amputating, one may use the Sturmdorf or the Schroeder operation. Sloughing and alarming postoperative hemorrhage are not uncommon after the latter operation. These complications may be minimized by using non-absorbable sutures, cutting them long, and delaying their removal until the fifteenth to the twentieth postoperative day.

Inflammation of the vagina may occur in a localized, acute or chronic form, giving the mucosa a spotted or mottled appearance; or the process may be diffuse. Although containing no glands (excepting Bartholin's and Skene's glands), the vaginal mucosa, when inflamed, exudes an acid transudate varying in amount and consistency.

Considering the proximity of the vagina to the irritating discharges from the urethra and rectum, and also the trauma to which it is subjected in childbirth, coitus, surgical procedures, and discharge from the cervix and uterus, one wonders that vaginitis is not more frequent. This immunity to infection is largely dependent upon the nature of the lining epithelium and its acid secretion.

Vaginitis may be caused by the various pyogenic cocci and bacilli, the micrococcus catarrhalis, Vincent's bacillus, Ducrey's bacillus, the tubercle bacillus, the diphtheria bacillus, various saprophytes and yeasts, and at least one protozoan, the trichomonas vaginalis.

In adults, the vaginal mucosa is strongly resistant to gonorrheal infection. This is not true in young girls up to ten years of age, in whom the gonococcus is the most common cause of vaginitis. In schools and institutions, gonorrheal vaginitis frequently assumes epidemic proportions. Sporadic cases are also frequent.

Hess,[7] in 1916, Stein, Leventhal and Sered,[15] in 1929, and Reichert,[14] in 1937, found an involvement of the cervix in these young girls in as high as 98 per cent of the cases, and suggest that the condition be termed cervicovaginitis rather than the commonly used vulvovaginitis, but TeLinde,[17] in a recent paper, claims that involvement of the endocervix is comparatively rare clinically.

Local treatment with 1 per cent of silver nitrate in equal parts of vaseline and lanolin injected into the vagina affords a high percentage of cures; 1/1000 merthiolate cream has been used with a great deal of success. If the cervix is involved, metaphen 1/500, 2 per cent acriflavine, or 1 per cent silver nitrate solution may be applied through a Kelly cystoscope.

Estrogenic hormones in doses of 1,000 international units, hypodermically, tri-weekly, give good results. Vaginal estrin suppositories containing 1,000 I.U. of amniotin have been found superior to the hypodermic injections, according to TeLinde.[17] Some clinicians think the cure results from a thickening of the vaginal mucosa; others, to an increase in the acidity of the vagina. Excellent results have been obtained by Karnaky[12] with the use of Floraquin-Searle tablets. Daily introduction of two or three tablets into the child's vagina can be done by the mother at home. This necessitates only weekly visits on the part of the child to the doctor's office. Good results are attributed to the maintenance of the vaginal pH at 4, which acidity favors the growth of Döderlein's bacillus and inhibits the growth of the gonococcus.

Hoffman, et al,[10] at the Cook County General Hospital, treated a group of twenty-five children, suffering from acute vulvovaginitis with sulfanilamide in daily dosage of ¾ grain per pound of body weight, in four equally divided doses every six hours for two days, after which the dosage was gradually diminished. They report seven of the twenty-five cured in an average of 17.3 days, and nine in an average of 42.9 days. Only two of the nine remaining patients were cured by further administration of the drug. None of the children (aged three months to ten years) suffered any toxic reactions.

In the last fifteen years, the trichomonas vaginalis has assumed an important rôle as the cause of vaginitis. It has been variously estimated that from 15 to 40 per cent of the cases of vaginitis are caused by this protozoan. Considerable controversy exists as to the exact causative agent and its origin. Clinically, with a trichomonas vaginalis infection, the discharge is foamy, bubbling, and greenish yellow in color and has a sweet odor. There are small reddened punctate areas throughout the vagina, and the cervix is reddened to such an extent as to be designated as a strawberry cervix. Probably, no other genital infection has been treated with such a multitude of remedies. Hesseltine[14] has recently studied the curative effect of three arsenical, one silver picrate, and two lactose preparations, and found that cures resulted from any of the preparations, in 85 to 90 per cent of

the cases. He claims superior results in a series of his cases from the introduction of one tablespoon of a powder, consisting of 95 per cent lactose and 5 per cent citric acid into the vagina after it has been wiped dry. The patient is instructed to insert a 30 grain tablet of this mixture into the vagina each night upon retiring.

At the University of Minnesota Health Service the routine followed in the treatment of trichomonas vaginalis consists of 5 grams of silver picrate powder (Wyeth) insufflated into the vagina after a thorough cleansing with hydrogen peroxide solution. The patient is instructed to insert a 2 grain suppository of silver picrate into the vagina each night for six consecutive nights. The patient then returns for another insufflation, again followed by suppositories for six nights. Winther[18] reports a cure in all of the twenty cases studied, with no recurrence for six months following treatment.

To Hesseltine, Borts, and Plass[9] must be given credit for calling our attention to the frequency of mycotic infections of the vagina. Perhaps 10 per cent of the cases of vaginitis are due to the two yeast organisms: the oidium albicans and the monilia. Yeast infections are very common in diabetes and in pregnancy and may persist for some time after delivery. The discharge is scanty and there are areas of involvement of the vaginal wall which have the appearance of cottage cheese. Itching is intractable and is the predominant symptom. Painting the vagina with Lugol's iodine solution in 0.25 to 0.5 of 1 per cent solution is almost a specific; a 1 per cent solution of gentian or crystal violet also yields excellent results.

Senile vaginitis develops after the menopause. The cause is unknown. The vagina is chronically inflamed. The walls bleed easily, and ulceration with adhesions often exist. Davis[5] has treated this condition with hypodermic injections of 100 rat units of estrogenic hormone two to three times a week, together with an additional 75 units, introduced daily in the form of vaginal suppositories. A cure usually results in two to four months. Adair and Hesseltine[1] report similar results with 95 per cent lactose and 5 per cent citric acid powder treatments given in the office at intervals of one to three weeks, together with the daily introduction at home by the patient of 1 to 2 gram pills of the same preparation.

Conclusions

1. The two most common causes of cervicitis and endocervicitis are injuries during childbirth and gonorrhea.

2. Sulfanilamide in appropriate dosage apparently effects a cure in acute gonorrheal cervicitis and vulvovaginitis in a high percentage of cases.

3. Hyperpyrexia effects a cure in 45 to 86 per cent of the cases in acute gonorrhea. The objections to this form of treatment are the danger of collapse on the part of the patient, the expense of the apparatus used, and the number of attendants necessary.

4. About one-third of the patients who visit the gynecologist do so because of chronic cervicitis. Cure is best obtained by linear cauterization of the cervix. Tincture of iodine, mercurochrome, argyrol and ichthyol have been proved to be practically worthless.

5. Lacerations of the cervix should never be repaired in the presence of existing inflammation.

6. Hypertrophy of the cervix may be treated by conization or amputation.

7. Estrogenic hormones in doses of 1,000 I.U. in vaginal suppositories, introduced daily, have been found to be superior to hypodermic injections of the same substance in the treatment of vulvovaginitis. Maintaining the vagina acidity at a pH of 4 or less, with Floroquin-Searle, as recommended by Karnaky, also gives good results.

8. Trichomonas vaginitis responds to treatment with citric acid and lactose preparation, or to silver picrate.

9. Iodine in the form of Lugol's solution is a specific for the monilia and oidium albicans infections of the vagina.

10. Senile vaginitis, may be treated with estrogenic hormones or citric acid-lactose preparations.

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Discussion

DR. W. F. MERCIL, Crookston: On entering into the discussion of Dr. Barry's paper, one feels that his admonition to concern ourselves very definitely with the causation and proper treatment of leukorrhea is a timely one. The mere suggestion to the female to "take a douche for your discharge" is not satisfactory to the more exacting woman of this day. Certainly, a thorough investigation, the determination of the etiology, and the proper applications of the new and old principles of therapy are essential factors in maintaining the proper confidence of the laity in our profession.

Acute gonococcal cervicitis and endocervicitis is not commonly seen in the early stage. Most patients seek medical attention after a six weeks period, when smears are usually negative. The incidence of this acute disease in the female has been reduced markedly in the past ten years in our locality. The high doses of sulphanilimide seem to be the most effective. The use of local applications in chronic cervicitis, endocervicitis, and eversions of the cervix has been quite disappointing. Linear cauterization with the thin nasal cautery tip has been routinely employed with good results. One must bear in mind the possibility of lesions higher up in the female genital tract, and not treat too readily the more obvious cervical lesion. Crossen leans to the idea that conization will be the accepted method of treatment in the more intensive cervical lesions.

In the diagnosis of various inflammations of the cervix and vagina, the appearance of the local lesions may be quite similar and our clinical impressions do not coincide with the laboratory findings. I believe this to be especially true in the cases of trichomonas vaginitis. One sees a patient with the symptoms of burning and itching and an irritating odorous discharge. On inspection, one may see the chafing of the inner thigh regions and vulva, and further, the typical, foamy, yellowish discharge, with redness of the vaginal wall, and fail to find the trichomona on repeated hanging drop preparations. Douches taken as early as twenty-four hours before examination will often be the cause of our failures in establishing a microscopic diagnosis. Repeated infections, or reinfections, may be due to poor hygiene. We instruct our patients to wipe the anus from front to back in an effort to prevent reinfection of the vagina from the anus. The growing number of reports in the literature of trichomonas in the male genital tract of interest, and reinfection from that source should not be overlooked. The urinary bladder is also to be considered as a possible source. Catheterized specimens of urine have been shown to contain the trichomonas in as high as 10 per cent of cases.

This brings us to the problem of curability of this disease. We can assure our patient of relief from symptoms temporarily, and in some cases get seemingly permanent benefits; but, in my experience, in the great majority of cases there is either a reinfection or a return of the previous infection. One hesitates to assure the patient of a permanent cure on the basis of the present methods of therapy. Insufflation with silver picrate, or Devegan powders, have been most effective. Care should be exercised to avoid too strenuous insufflations during pregnancy.

Yeast infestations are more common in pregnancy. The intense itching, if not due to the trichomonas, can usually be traced to the monilia infection. In our series, 1 per cent solution of gentian or crystal violet were applied locally with good results. In two cases, no definite benefit was obtained until local water-cooled ultra-violet applications were used, and with three treatments all symptoms and local inflammatory reactions subsided. This method of therapy would seem to be of benefit in certain highly resistant forms of yeast infections.

In the treatment of senile vaginitis, we prefer the local instillation of estrogenic suppositories, rather than its hypodermic use as this seems to be sufficient in most cases.

OBSTETRIC HEMORRHAGE*

ROY E. SWANSON, Ph.D., M.D.

Assistant Professor of Obstetrics and Gynecology, University of Minnesota

Minneapolis, Minnesota

IN the last few years, both the medical profession and the lay people have shown an ever increasing interest in maternal mortality. The recent excellent maternal mortality rates reported for Minnesota are to be taken, we hope, as a measure of better and more conservative obstetric practice in this state. It can be said, without fear of contradiction, that much of the credit for this trend is due to the type of teaching given by our retiring chief, Jennings Crawford Litzenberg. For many years, he has taught a most conservative type of obstetrics; and nothing could be more fitting than to have his last year at the University marked by the lowest maternal mortality rate in the history of the state.

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Among the outstanding causes of death in pregnancy, labor and the puerperium are sepsis, toxemia and hemorrhage. Hemorrhage and sepsis are very closely correlated in many cases, since the factors causing hemorrhage are many times factors in fatal sepsis. Sepsis which otherwise would not have resulted fatally may, if preceded by severe hemorrhage, lead to death. Sepsis so often results from meddlesome interference or major operative procedure with consequent abnormal blood loss and trauma, and so often follows toxemia, that it is difficult to evaluate the part each one plays in many deaths.

The recent and at times brilliant results that sulfanilamide has given in the treatment of puerperal sepsis will probably reduce the fatalities from this cause and will give hemorrhage a higher rate as a cause of death in labor.

The prevention and prompt treatment of hemorrhage should help to reduce maternal mortality. All procedures which are associated with the possibility of obstetric hemorrhage should be approached with the greatest caution even though methods for its treatment are immediately at hand.

Obstetric hemorrhage can most easily be discussed under the following headings: abortion, ectopic pregnancy, placenta previa, ablatio placentæ, and postpartum hemorrhage.

Abortion

Approximately 25 per cent of all maternal deaths are due to abortion. The criminal abortionist plays a large part in this with the introduction of infection and his refusal to take part in the treatment of subsequent hemorrhage. Sepsis, of course, plays a leading rôle. Death from hemorrhage following abortion should be rare, yet it causes about 10 per cent of deaths due to abortion. Prompt reporting of any bleeding in early pregnancy will save many lives. Facilities for curettage, packing the uterus and blood transfusions are essential. A firm stand on the part of the medical and legal professions in opposition to the professional abortionist would reduce maternal mortality in the United States by thousands yearly. Recent advances in the teaching of birth control will do much to avoid unwanted pregnancy. In time, it will cause a marked reduction in induced abortion. Spontaneous abortions are much better cared for since these patients are in most instances under adequate care. In the criminal abortion, however, the patient is as a rule away from home and friends, and is in no position to get good medical care until she is in extremis.

Litzenberg's classification of abortions into the decidual stage of pregnancy; the attachment stage of the placenta; and third, the placental stage, offers help in the treatment of this condition. In the decidual stage, present during the first six weeks of pregnancy, an abortion is likely to be complete with little bleeding, and curettage is rarely indicated. During the second six weeks, good attachment has taken place and an abortion at this time often causes hemorrhage and pain, and placental remnants are apt to remain. In the third type, after the third month, the abortion is more like a normal labor and the placenta is usually expelled completely. There is not much danger of hemorrhage unless the placenta fails to separate completely.

Ectopic Pregnancy

Death from ectopic pregnancy is due chiefly to neglect on the part of the patient, and errors in diagnosis. Approximately 60 per cent of these deaths are due to hemorrhage. Any bleeding in pregnancy, at any stage, must be considered of sufficient importance to warrant prompt investigation and diagnosis. Where a diagnosis is doubtful, sharing of the responsibility can easily be had through consultation. With the history of a missed menstrual period, moderate vaginal bleeding and abdominal pain, ectopic pregnancy must be considered. The patient should preferably be sent to a hospital for careful observation. When the diagnosis is established, prompt operation is indicated and transfusion may be necessary. The replacement of blood loss by saline, glucose, acacia, or, better, blood transfusion is not to be neglected before, during, or after the control of internal bleeding. Since 60 per cent of deaths in this condition is due to hemorrhage, it is obvious that this procedure must have been neglected. It is not usual for a patient to die at the first rupture. This fact gives us, as a rule, adequate time to prepare for operation. Fewer deaths should occur from hemorrhage in ectopic pregnancy.

Placenta Previa

Any bleeding in the third trimester of pregnancy should be considered serious until a diagnosis is made. The diagnosis should be possible

placenta previa until proven wrong. This attitude should necessitate immediate hospitalization except under unusual circumstances. No extensive examination should be made until this is done and all preliminary preparations for transfusion, bag or section are made. This diagnosis is not always easy. Usually the only symptom is painless bleeding which is frequently negligible at the onset. The presenting part is usually not engaged except in the marginal type. The rectal finger should feel a mass in front of the presenting part, and this examination usually should cause more blood loss. X-ray assistance may be had in vertex presentations by injecting silver iodide into the bladder. One may, by this means, especially in central attachment of the placenta, show the placenta between the bladder and the fetal head. This test is by no means pathognomonic and should only be used as an additional aid in the diagnosis.

The treatment of placenta previa has been more or less standardized. Williams taught that when such a diagnosis is made, the uterus should be emptied at once. At the University, Litzenberg allows time for observation and preparation of the patient, depending, of course, on the severity of the case. In central attachment, cesarean section is the procedure of choice. In partial or lateral attachment, this is also the most acceptable, especially in the primigravida. In marginal types, if the patient's condition permits, vaginal delivery may be the wisest choice where the head is engaged. Either the membranes may be ruptured or a bag inserted, and version performed later if necessary. Packing before delivery should be condemned except in rare instances. Braxton Hicks version is rarely resorted to in well trained communities. The uterus is best packed when delivery has been accomplished. In many instances the placenta must be manually removed in the presence of brisk post-partum hemorrhage. The mortality rate in the babies is high both because of blood loss and prematurity as well as from trauma. Since this is true, most of our efforts are expended in the interest of the mother. Prompt diagnosis, well planned treatment in a hospital, and blood transfusion will save many mothers in this serious condition. The prognosis is always serious. Even under good management the mortality varies between 3 and 10 per cent, and as high as 40 per cent in those poorly managed. The mortality rate can be reduced by prompt recognition of the dangers of blood loss, hospitalization and courageous treatment.

Ablatio Placentæ

Ablatio placentæ or premature separation of the normally placed placenta is the accidental hemorrhage of our fathers. This term, accidental hemorrhage, was used to designate a condition in contradistinction to that seen in placenta previa. It represents hemorrhage from a normally placed placenta, the hemorrhage being either concealed or visible. It results in the frequent death of the baby and premature labor. The concealed type, characterized by a uterus of board-like consistency, is the most dangerous and usually requires cesarean section with hysterectomy if the uterus is apoplectic. In these severe cases the uterus fails to contract and the mother may die in spite of packs, pituitrin and blood transfusions. The milder types may be treated by bag and version if labor is not already in progress. Ablatio placentæ occurs late in pregnancy or during labor. There may be a great blood loss with acute anemia and shock, especially in the concealed type. When one finds a firm board-like enlarging uterus with signs of shock, the diagnosis is simple and the treatment is section. The prognosis for the mother is grave, the death rate running from 35 to 50 per cent in the severe type. The fetal mortality runs from 80 to 95 per cent. Here again hospitalization and prompt treatment are essential. Blood transfusions are extremely important in the severe concealed types.

Postpartum Hemorrhage

Postpartum or postnatal hemorrhage usually occurs during, or immediately after, the third stage of labor. It may be divided into primary hemorrhage occurring during the first twenty-four hours, secondary from twenty-four hours to two weeks, and puerperal from two to six weeks postpartum. Hemorrhage postnatally may be considered to exist when more than 500 c.c. of blood is lost. The normal blood loss should not exceed 300 c.c. The danger does not always lie in the amount of blood loss, but the condition of the patient before the blood loss. The predisposing causes are usually listed as due to blood diseases, anemias, cardiac disease, debility, malnutrition, multiple pregnancy, repeated pregnan-

cies, atony, and certain types of women such as blonds and redheads.

The immediate and local causes are, in general, excess use of pituitrin, prolonged anesthesia or labor, atony, overdistension of the uterus, lacerations, operative delivery, improper conduct of the delivery of the placenta before its normal separation, and retained placenta.

The best treatment for postpartum hemorrhage is its prevention. Be on the lookout for it and treat it promptly. Give plenty of rest and fluid in long, fatiguing labors. Avoid the excessive use of oxytoxic drugs during labor. In operative deliveries, do not use too much haste, and avoid trauma. Do not attempt to deliver the placenta, if possible, until it is separated. Look the placenta over carefully to rule out retained portions. Use ergot and pituitrin by hypo immediately after the birth of the baby in difficult and fatiguing labors. Watch the uterus after delivery and hold it, if possible, for one hour after delivery. Have a speculum and big pack always available for packing the uterus. In patients who have had antepartum bleeding, always be prepared for postpartum hemorrhage. Hemorrhage in the presence of a well contracted uterus calls for inspection of the cervix and ligation of bleeding vessels. The essential treatment for the hemorrhage is blood transfusions, fluids, morphine, and good nursing.

Discussion

DR. A. K. STRATTE, Pine City: Dr. Swanson has covered the subject very completely, and there is very little to add. I wish to emphasize a few points he has mentioned, especially as they affect the general practitioner, namely, adequate prenatal care, conservative use of instruments and oxytoxics, and the proper diagnosis of emergencies when they arise. As he stated, there has been a marked improvement in maternal mortality rates, especially in this section; but fewer deaths should occur from obstetrical hemorrhages. During the past few years, perhaps more spectacular advancement has been made in other branches of medicine than in methods employed in the treatment of these conditions. Were all the available knowledge put into common usage, the mortality rate would be appreciably reduced. For example, in reference to placenta previa, Dr. Swanson states, "The mortality rate varies between 3 and 10 per cent and as high as 40 per cent if poorly managed."

Wherein lies this great discrepancy and where can the blame be placed? First, failure to recognize or heed the warning of third trimester bleeding, which is usually not severe at the onset. Second, failure to place the patient in a hospital under the care of a man capable of handling the case. Some general practitioners who willingly refer cases to specialists in other branches of medicine, do not call in an obstetrician even though it is clearly indicated. How else can the large variance of 3 to 40 per cent mortality rates in placenta previa be explained? The average general practitioner cannot be expected to carry the equipment, nor have the training necessary to care properly for these emergencies in the home.

The final diagnosis of bleeding in the third trimester should never be attempted in the home, because of the increased hemorrhage which usually follows examination. However, certain signs might give you a fairly accurate opinion of the cause.

In placenta previa, hemorrhage is apparent, intermittent and painless. The uterus is normal in size, shape, and consistency. On the other hand, in premature separation of a normally implanted placenta, hemorrhage, though usually apparent, may be concealed, the pain is sudden in onset, severe and continuous in nature, and the uterus is often larger than normal, hard and sensitive.

The initial hemorrhage usually being slight, morphine may be administered and removal to a hospital can usually be safely accomplished. Packing should be avoided unless the hemorrhage is excessive. Prevention of obstetrical hemorrhages begins with thorough painstaking prenatal care. Harris states that premature separation of the placenta occurs four times as frequently in toxemic patients as in those in which toxic manifestations are absent. Bleeding, no matter how slight, during any of the three trimesters should not be regarded lightly.

Postpartum hemorrhages are chiefly of two types, traumatic and atonic. If the uterus is hard, the bleeding comes from laceration, which should be searched for with the aid of a speculum, and repaired.

In the absence of trauma, the bleeding is usually atonic. Normally, bleeding is controlled by three factors: (1) contraction of the uterine muscle fibers; (2) retraction of uterine muscle fibers; (3) clotting which occurs in the vessels.

The contraction and retraction of the muscle fibers of the uterus produce a compression and kinking of the arteries, and this controls the bleeding. Conditions which prevent these normal functions are toxemias, uterine exhaustion, and adherence of the placenta to the uterine wall with a partial separation. Prophylactic treatment consists in proper prenatal care, to avoid or detect toxemias which predispose to the atonicity of the uterus. Exhaustion during labor should be avoided by rest and intravenous glucose. Avoidance of haste in expressing the placenta, conservative use of instruments and oxytocis will reduce postpartum traumatic hemorrhages. More accurate clinical diagnosis would necessitate fewer retrospective diagnoses on the death certificate.

CASE REPORT

RUPTURE OF DUODENUM IN A THREE-YEAR-OLD CHILD

O. S. WYATT, M.D.

Assistant Professor of Surgery, University of Minnesota

Minneapolis, Minnesota

BEING unable to find a report in the literature of a rupture of the duodenum in a child so young, I felt that this case warranted reporting.

This three-year-old boy was first seen by Dr. Lane Arey of Excelsior, Minnesota, about 5 p. m., May 9, 1938. The history obtained was that the lad, while climbing up the side of a large flower urn, pulled it over on top of himself, so that it struck him across the upper abdomen and lower rib margin on the right side. He ran at once to his mother complaining of pain in the "tummy." He was seen by Dr. Arey within fifteen minutes and complained only of abdominal pain. His appearance, pulse, and blood pressure were normal. He was taken home and put to bed. At 8 p. m., three hours after the accident, he was again seen by his attending physician. He was complaining of severe abdominal pain, presented a picture of severe shock, and the right half of his abdomen was rigid. His blood pressure was 112 systolic and pulse rate 140 per minute. He was taken at once to Janney Children's Hospital, and I had the privilege of seeing him about 9:30 p. m., four and one-half hours after the accident. He was very apprehensive and alert. He presented a typical shock facies, abdominal pain was severe, B.P. 100 systolic, pulse 160. Examination of the chest was negative. Examination of the abdomen revealed a mild contusion across the lower rib margin on the right side. The abdomen, moderately distended in the epigastrium, was otherwise normal in appearance.

Percussion revealed no fluid level and liver dullness was questionable.

Palpation revealed marked rigidity of the entire right abdomen, and moderate rigidity of the left. He was extremely tender in the right upper quadrant, moderately so in the right lower quadrant, and no tenderness was elicited in the left abdomen.

Flat plates were made of the abdomen but they revealed no gas beneath the diaphragm.

Our impressions were that this boy had a ruptured liver, with the possibility of a ruptured hollow viscus.

Operation.—After transfusion had been started, an upper right rectus incision was made under ether anesthesia.

Upon opening the peritoneal cavity no free blood was encountered, but a copious amount of dirty serous fluid. After aspiration of the free fluid, inspection of the liver revealed that it was normal. However, a great deal of plastic exudate was found in the region of the hepatic flexure, along the entire ascending colon, and down into the right lower quadrant. Even the appendix was covered with a plastic exudate.

Upon exploring in the region of the gallbladder, free bile was encountered and a large hematoma was noted on the anterior surface of the duodenum. There was also a large hematoma on the hepatic flexure of the colon, and in the retroperitoneal tissues. It was quite evident that the trauma was limited to this region.

Exploration of the duodenum for the possibility of a rupture revealed that bile was escaping into the peritoneal cavity. The duodenum was mobilized as much as possible and on the lateral surface of its second portion a longitudinal rent about 1.5 cm. in length was found through which bile was escaping. The mucosa was puckering through the opening. The tear was closed by whipping over Duloc sutures, and I was unable to express any more bile through it. Further examination of the duodenum revealed no more lacerations, and I could not express any bile from the lesser peritoneal cavity.

Inspection of the stomach, transverse colon, and terminal ileum revealed no other perforations. The omentum and mesentery were normal.

Soft rubber drains were placed in the region of the gallbladder and right lower quadrant. Closure of the abdominal wall was done in layers.

While the operation was going on the boy received between 350 and 400 c.c. of his father's blood. He left the table in good condition.

Naso-duodenal suction was employed on this boy for seventy-two hours, during which time he received intravenous feedings. His abdomen remained flat and at no time did he ever present any distention. On the fourth day the naso-duodenal tube was removed and feeding commenced by mouth. The convalescence was smooth with the exception of a slight wound infection, which healed by secondary intention in about eighteen days.

The patient was discharged on the twenty-fifth day. When seen three months after the accident he was in perfect health, and the mother states that she would never know that anything had ever happened to him.

Discussion.—This case is reported because of the interest it created, and likewise because the child in the case is probably the youngest on record.

Rupture of the duodenum is extremely rare following trauma to the abdomen. Rowlands reported only twenty-three cases of ruptured duodenum in 381 cases of ruptured intestines. Probably the reason that we see so few ruptures of the duodenum is because it is so well protected except where it crosses the vertebral column.

The symptoms in this case surely indicated an acute surgical abdomen, but because free gas was absent or undemonstrable in the peritoneal cavity, rupture of a hollow viscus could not definitely be diagnosed. The presence of free bile in the peritoneal cavity led us at once to suspect injury to the biliary apparatus or duodenum. We were fortunate in having a laceration which could easily be taken care of, and likewise fortunate that none were overlooked.

I consider it a privilege to be able to report this case and wish to express my sincere thanks to Dr. Lane Arey for his helpful assistance and suggestions.

HISTORY OF MEDICINE IN RAMSEY COUNTY

BY J. M. ARMSTRONG, M.D.

(Continued from October issue)

In the *Pioneer* for February 13, we note the following satirical squib:

"Dr. Charles M. Berg has slid off down the river. Berg was one of the large number of nice young men who flocked into Saint Paul last summer for office, but, like the majority, was disappointed. For several weeks past he has patronized the hotels, oyster shops, barbers, livery stables, and washwomen of Stillwater. It is said that he got into debt to about the amount of $1,000.00. Some ten days ago, the Doctor joined a trouting party to Rush river. Professing to have some business a short distance farther down the river, he left the party with somebody's horse and cutter and went down. The Doctor appears to have lost all command over the horse; for instead of returning to the fishing party next morning, a company of surveyors coming up the river reported that they met the Doctor near the foot of Lake Pepin, with his horse's head turned southward and under full speed. If the Doctor ever returns, he will probably sue the owner of the horse for the damage of running away with him."

It seems that the doctor, horse, cutter, and baggage went through an air hole in the river, but the doctor managed to extricate himself (*Pioneer*, March 13):

"The river below soon after opened and the ice commenced running. The Doctor acts like Croton oil and is bound to have a free passage through the world."

He sold his plunder at Prairie du Chien and when last heard of had reached Galena on his way to Philadelphia. Nothing further concerning Dr. Berg can be learned except that he was one of the organizers of the first Masonic lodge instituted in Saint Paul in 1849.

Both Dr. Potts and Dr. Day came to Saint Paul, as said before, in 1849, though Potts may possibly have been there previously, as he was married at Fort Snelling in 1847. In the *Pioneer*, under date of May 19, his professional card appears as follows:

Dr. T. R. Potts

Having made Saint Paul his permanent residence will attend to all calls in his profession in the town and county. He may be found at the store of Mrs. W. H. Forbes.*

Drs. Potts and Day apparently got an early hold on the community for we find them among the managers of a ball held July 4. Dr. Carli of Stillwater was also on the committee. This same year Dr. Day was appointed Register of Deeds for the newly organized county, and he recorded the first deed in Ramsey County. Dr. Potts was elected president of the Board of Trustees of the town. We may say he was Saint Paul's first mayor.

It is recorded also in the annals of Saint Paul that Dr. Day drew the plans for the first courthouse, for which he received the sum of ten dollars. This seems to be more of an exploit than the bare statement may indicate, as bids for plans

*Forbes represented the American Fur Company in Saint Paul and his store was known as the "Saint Paul Outfit." The store was on Bench Street (2nd Street) near Jackson.

were not advertised for till January 16, 1850, and had to be in the hands of the Commissioners by noon on the 20th. It is possible no others were able to compete on such short notice. Dr. Day was also one of the commission which built the court house, the construction of which was begun in 1885. His duties as Register of Deeds apparently were not strenuous. To correct the erroneous rumor that he had given up his practice, he published the following card:

"Dr. Day continues the practice of his profession at Saint Paul and will be found at his office on Third Street."

Dr. Dewey was not behind Drs. Day and Potts in social and political standing. In 1849, he was elected to represent Ramsey County in the first territorial legislature and served as a member of the executive committee of the Territorial Temperance Society, organized on October 30. At the same time that Governor Ramsey appointed Dr. Day Register of Deeds, he appointed Charles Bazille Coroner for the county. Judge Bazille, his son, stated that there were many offices to fill and few reliable men to fill them. When the appointment of coroner came up, someone remarked, "Give it to Bazille, he's the only white man left." There was some truth in the jest, as Bazille could not read or write. This same year the first dentist came to Saint Paul, though he did not become a permanent resident till 1851. His announcement under date of May 9, 1850, is curious. It reads as follows:

Dr. Jarvis

Dentist and Daguerrean

Will arrive in a few days and respectfully solicits from the citizens of Saint Paul, Stillwater, and The Falls of St. Anthony their patronage and support. He would particularly call their attention to the fact that he comes to stay and make Minnesota his home for life. His stock of materials, both in the Dentist and Daguerrean line, is most extensive and complete. Pictures taken in superior style in clear and cloudy weather.

5th Street near Jackson

This was Dr. William H. Jarvis, not only our first dentist but our first photographer. He was not the army surgeon of the same name stationed at Fort Snelling in 1836. In January, 1851, he opened a small drug store and advertised as a homeopathist; in August of the same year he opened a dental office in St. Anthony, intending to divide his time between the two places. In the spring of 1852 he closed out his daguerreotype business, and enlarged his drug store with capital furnished by Dr. J. H. Day, calling it "The Multum in Parvo Drug Store." After a number of years he gave up the drug business and opened a nursery on the west side of the river, raising vegetables and small fruit. He died in Saint Paul in the eighties. He is said to have been an Englishman and was born about 1828.

During the year 1849 a man whose name is still well known to the local medical profession located at St. Anthony and began the practice of medicine there. He received his diploma from Rush Medical College in 1850, and moved to Saint Paul in 1863. He is included here at this time because St. Anthony was then part of Ramsey County and his later activities were in Saint Paul. His name was John Henry Murphy.

John Henry Murphy was born January 2, 1826, at New Brunswick, N. J. He received part of his education at Quincy, Illinois, and boarded for a time with the parents of William W. Sweney while he and young Sweney studied medicine together under Dr. Abraham B. Hull of Marietta, Illinois. Following the custom of the day he established his practice before receiving his diploma, settling at St. Anthony. In 1850, he returned to Rush Medical College and completed his course. He practiced medicine at St. Anthony for ten years until the Civil War broke out

and he went into the army. His family then moved to Saint Paul, and to the latter city he returned upon his discharge in 1863, to continue his practice until his death January 31, 1894. He was a member of the state constitutional convention and of the state legislature, and served for many years as Surgeon General of the state. He was also at one time president of the Association of Railway Surgeons, president of the Board of Pension Surgeons, and a member of the Saint Paul school board.

He was a large, uncouth man, uneducated, and possessed of a rather broad sense of humor. He had the reputation of being a great surgeon, and he firmly believed it himself. Although he did curious and bizarre things in surgery, his patients never seemed to hold it against him. He would do anything in a rough and ready way except eye surgery, and he firmly believed that all surgical patients in the community belonged to him by right, particularly fracture cases. It mattered not to him who their physician might be, or whether or not he was sent for. In many cases the ethics of practice as generally understood seemed to be absolutely incomprehensible to him. When a fellow doctor complained to him of a breach of etiquette such as stealing a surgical patient, he would make apologies, only to do the same thing again the next day, naively unaware that he had done anything wrong. In many ways he was a most lovable man, greatly liked and widely known. Probably there have been more curious stories told about Dr. Murphy than about any physician who ever lived in Saint Paul. Many young men, notably Edson Wait, James J. Dewey, Henry F. Hoyt, Ed. Whitcomb, James A. Quinn, and Clinton C. Miller, studied in his office. For many years in the early days he was the only physician in Minnesota who belonged to the American Medical Association. He served at different times as surgeon in the First, Fourth, and Eighth Minnesota Regiments and also was Division Surgeon. He was president of the Ramsey County Medical Society in 1874. At the time of his death he had perhaps a wider acquaintance than any man in the city.

Another physician came to Saint Paul with Governor Ramsey in 1849, Dr. Thomas Foster. He had practiced medicine in Pennsylvania but probably did not practice in Saint Paul. He came there as secretary to the governor, being at that time thirty-one years of age. In 1852 he was appointed physician to the Sioux Indians and later engaged in the drug business. As part owner and editor of the *Daily Minnesotian,* during the years 1857-61, he was one of the early newspaper men in the state. He served in the Civil War, attaining the rank of captain in the commissary department. In 1869 he established the Duluth *Minnesotian,* the first newspaper to be published in that city. He was born in Philadelphia, May 18, 1818, and died in San Francisco, March 31, 1903. He is said to have coined the phrase "The Zenith City of the Unsalted Seas" as descriptive of Duluth.

During this year cholera made its first appearance in Saint Paul. One of those who died was L. B. Larpenteur, the grandfather of the late A. L. Larpenteur. He was buried at the head of Jackson Street, about where the city market is now. Later his remains were removed first to a cemetery situated at the present location of St. Josph's Academy, and still later from there to Calvary Cemetery.

The year 1850 found a surgeon-dentist, Dr. A. G. Stiphers, announcing his skill in making artificial dentures:

> "Scurvy and all other diseases of the gums, mouth and teeth cured, charges moderate, all work warranted."

Just how frequent scurvy was at that time is not known; but presumably it was not infrequent, as fresh vegetables were difficult to secure in the winter, and it was thought Minnesota was too cold for the raising of potatoes. Furs,

cranberries, and pine lumber were the only products exported from the territory. In contrast to the difficulty of securing fresh provisions, whisky was cheap enough, twenty-five cents a gallon "and a better quality for twenty-eight cents." During this year also, Drs. Lee and Reynolds, both dentists of Dubuque, announced that one of them would spend a few weeks in Saint Paul and do dental work. A Dr. Todd who appears as a resident of Saint Paul and a member of a river excursion on July fourth was probably a clergyman, not a doctor of medicine. Although the town was but one year old, political squabbles and animosities were already rife, as is instanced by this note on the editorial page of the *Pioneer* for March 6:

"It is gratifying to learn that T. R. Potts, M.D., late of Galena, has been promoted to the office of Sioux doctor and Chief Surgeon to his Majesty Little Crow. It is a sphere for which he is better adapted than any other he has heretofore occupied."

What it was that excited this sarcastic tribute from the acid pen of James M. Goodhue, the paper does not state. Dr. Potts held this appointment till late in 1850, when Dr. Williamson was reappointed. Dr. David Day became the examining physician for the National Loan Fund Life Assurance Society of London and New York, the first life insurance company to establish an agency in Saint Paul. Late in December Dr. C. Rich opened an office in the building formerly occupied by Dr. Barbour's store on Third and Minnesota Streets. By 1850 Barbour had moved to another town, having sold his store to Wm. W. Hichcox. Sometime during the year Dr. William Wilson Sweney came to Saint Paul. He had been studying medicine under a preceptor for three years but had not as yet received a diploma. Dr. Sweney's activities are recorded in the section of this book relating to the medical history of Red Wing.

It may be of interest to insert here the deaths occurring in the "District of the County of Ramsey, Minnesota Territory," for the year ending June 1, 1850, as they appear in the census of 1850.*

Name	*Age*	*Place of Birth*	*Days Ill*	*Cause of Death*
Pierre Gervais	8	Minn. Territory	42	unknown
Magdeline Donna	60	Canada	15	fever
Atoine Bourais	80	Canada	30	pulmonary
Zoe Bivot	25	Canada	2	cholera
John Baptiste	2	Canada	30	pulmonary
Sophie Poncin	7	Minn. Territory	3	cholera
Alex. Ramsey, Jr.	4	Pennya	14	fever
W. A. Forbes	6/12	Minn. Territory	21	inflam brain
Phoebe Glass	8	Wisconsin	2	burned
Mary Jane Barber	5	Iowa	3	congestive
Albert Barber	2	Iowa	3	congestive
John Lurmley	23	Ohio	1	cholera
James Green	40	Pennya	1	cholera
Elijah Gladden	35	Ohio	5	cholera
Francis Robert	25	Missouri	90	consumption
James Goodhue, Jr.	2	Wisconsin	20	teething

In the manuscript division of the Minnesota Historical Society may be found the early account books of Dr. Potts. The first entry is dated May 20, 1849, the day after he arrived in Saint Paul. It seems worth while to give here some of the entries in his books. It should be noted that in all instances he gives the

*It is probable that the deaths from cholera occurred in the summer of 1849 rather than in 1850, at least John Lumley (not Lurmley) who worked for Larpenteur died in 1849. Barber should be spelled Barbour in the above.

names of his patients and the fee charged, but no case histories. His books are a veritable directory of Saint Paul at that time.

1849 June 11—Blister .50
July 24—E. Rice—to obstet. 20.00
Sept. 8—Visit to the Falls 9.00
Sept. 27—Visit to Ft. Snelling 7.00
Dec. 5—Visit & Med. 80.00 Sauk Rapids

1850 Jan. 29—Obstet & detention 35.00
Feb. 28—to advice & med syphilis 25.00
March 14—to visit and scarifying gums 1.00
May 20—visit and consultation Dr. Day 5.00
May 24—visit at night 2.00
May 30—v. & opening abscess 3.00
June 10—to visit & med (Falls) Smallpox 10.00
July 20—obstet 10.00
Aug. 6—obstet 5.00
Aug. 6—extracting mote from eye 1.00
Sept. 29—visit and Mendota 6.00
Oct. 12—dressing wound 2.00
Oct. 25—visit and blister 1.25
Nov. 3—visit and consultation (Falls) 10.00
Nov. 8—reducing luxation 10.00

1851 Jan. 15—J. M. Goodhue—to dressing wound 10.00
April 25—D. A. Robertson—to visit and chloroform 1.00
May 28—J. R. Brown—to extracting bone from throat 1.00
Nov. 15—setting fracture 5.00

1852 Jan. 23—visit and cupping 1.00
May 23—visit & setting arm 10.00
July 25—E. Rice—consultation Dr. Day 5.00
Oct. 29—Setting fracture 10.00

1853 Feb. 27—reducing hernia 5.00
May 31—reducing fracture 10.00
Sept 5—C. W. Borup—reducing fracture 20.00
Oct. 28—reducing dislocation 5.00

1854 Jan. 4—Post Mortem of Philip Hull 20.00 (chg. County)
June 26—to operation of trephining 10.00
July 1—to consultation Dr. Day 5.00
15.00
Aug. 10—D. C. Dustin—to att'd & detent on self (cholera) 10.00

1855 Jan. 25—Consultation Dr. Goodrich 5.00
March 15—Consultation Dr. Morton 5.00
March 26—Consultation Dr. Wren 5.00
April 3—tapping hydrocele 5.00
April 4—to Morrison (Hospital) with Dr. Marsh 1.00
May 16—Consultation Dr. Marsh 5.00
July 12—Haskin (Winslow House) consultation Dr. Stewart 5.00
Nov. 17—Seager
To att. on wife 20.00
By cash 10.00
By copy of Shakespear 10.00
Nov. 20—Introducing catheter 5.00

His ordinary fee for a visit was $1.00. Sometimes a small amount, as 28 cents, was added for medicine; night visits were $2.00. The word "detention" means that he was detained for a long time. In the case of Dustin he spent the entire day with his patient. Mileage was charged for visits to St. Anthony, Fort Snelling, Mendota, and Sauk Rapids. This last visit evidently occupied three or four days

as there are no entries on his books for one day before and two days after. It is interesting also to note that he never received his fee for this trip. The mention of chloroform in 1851 is rather early for this part of the country. The total of his charges for the year 1850 amounted to $1,224.53. He received during that period $69.80 in cash, a cupboard, one load of wood, and one dozen chickens. He seems to have made no particular effort to collect his accounts during the years 1849 and 1850, and his ledger was made up in 1851, probably by his wife. It is interesting to attempt to compare his book charges with those of today. The overhead charges in practicing medicine today are from 37 to 40 per cent, while his at that time could have been but a fraction of that. If one knew what percentage of his accounts he was able to collect and what was then the cost of living, one could arrive at a figure indicating the financial status of a physician in Saint Paul at that time. From the names on his books, only a few of which have been given, it appears that he had the best practice of any Saint Paul doctor during those years. During the months of June and July, 1850, are many charges for vaccination at one dollar each. It is also noted that on March 5, 1855, the writer's grandfather paid him $53.00 for attendance on his wife, who suffered from an attack of typhoid fever in the autumn of 1854.

1851

In April Dr. Barbour returned to Saint Paul and began again to solicit "a share of public patronage," announcing "he will practice upon the Eclectic Reform Principle, discarding mercury in all its forms." The name of the coroner for this year is not known, but a notice of an inquest to be held May 22 was signed Orlando Simons, Acting Coroner. Simons was not a physician. On May 29 Dr. Sweney returned to Saint Paul, after receiving his diploma from Rush Medical College. He opened his office on St. Anthony Street (West Kellogg Boulevard) next door below Mr. J. Irvine's (between Washington and Franklin Streets). Lee and Reynolds, the traveling dentists, again visited Saint Paul, and Dr. I. B. Branch, a Galena dentist, made a trip up the river and advertised he would be at the American House (N. E. corner Kellogg Boulevard and Exchange Streets) for a few days. Some time during the latter part of the autumn, Dr. Charles Rich moved from Saint Paul to Dubuque. He was evidently employed at some time during his stay in Saint Paul as county physician, for on one occasion he collected a bill from a patient, and also received $5.90 from the county for the same case.

The *Pioneer* of September 4 makes the following comment regarding him:

> "Dr. C. Rich and family left by the Nominee last week, being in debt to many people in St. Paul and especially to the printer. This reminds us of the old maxim 'Riches take to themselves wings and fly away' and we cannot help heartily and meekly responding 'Give us, Oh Lord, neither Poverty nor Riches.'"

The rapid growth of Saint Paul and the neighboring country is evidenced by the arrival of six more physicians later in the year. These men were Dr. James D. Goodrich (Sept. 25), Dr. John Harvey Day (Oct. 9), Dr. Albert G. Brisbine (Oct. 16), Dr. O. E. French (Oct.), Dr. R. Babbitt and Dr. Carlios (Nov.). Dr. Goodrich opened an office in the "Democrat Building, Wabashaw and Third Streets"; Dr. Day, "Office on Bench Street" (now 2nd Street); and Dr. Babbitt "in the rear of Levi Sloan's Store" (Kellogg Boulevard between Franklin and and Washington Sts.). Goodrich, Brisbine, Day, and Babbitt had simple cards in the paper announcing their arrival and where they might be found. Dr. French's announcement, however, is worth giving in full, as is also that inserted by Dr. Carlios. They are as follows:

O. E. French, M.D.
Surgeon and Physician

Graduate of Harvard University, Cambridge, Mass. Dr. F. believes it is a duty, as a stranger, he owes himself and the community, as he intends to make Saint Paul his permanent residence, to state that he has had many years' experience in the hospitals and practice of the Eastern Cities, and also of the diseases of the Mississippi Valley,—is a graduate of the oldest and first University of the country, and was for a number of years the private pupil of the most eminent surgeons and physicians of New York, Boston and Philadelphia. Dr. French will give particular attention to diseases of women and children, and respectfully offers his services in the practice of Surgery, Medicine, and Midwifery to the citizens of Saint Paul and vicinity.

References

Drs. Crow, Ray, Robertson, Kittoe, etc., Galena; Messrs. Hollingshead, Rice, and Becker, Mr. Roberts, J. W. Simpson, S. H. Sargent, Gen. McBoal, St. Paul.

Dr. Carlios
Surgeon, Physician, and Accoucheur

A graduate of the Paris and Turin Universities has taken his residence in Saint Paul. He will take pleasure in exhibiting his diploma to anyone who desires to see it. Dr. C. will have his office at Mr. Turpin's on Fourth Street, Saint Paul; where he can be found and will promptly attend to every call.

N. B.—Dr. C. has instruments of the most approved kind for every surgical operation ever required.

It is interesting to compare these announcements with the modest professional cards of Goodrich, Babbitt, Brisbine, and Day. The claim of Dr. French that he was a Harvard graduate is verified by the catalogue of that university. He led a rather peripatetic existence, as shown by the attached biography. As to Carlios, Paris and Turin Universities are too far away to make the search for his name. In October, at the county election, P. T. Reid, a merchant, was elected coroner over W. Chapman, receiving 288 out of 534 votes.

One of the principal events of the year 1851 was the encounter between James M. Goodhue and Joseph Cooper, which occurred on January 15. Both men were wounded. The latter lived for a short time; the former died on August 27, 1852. Although his political friends asserted that his death was occasioned by the wounds he received, his survival for a year and a half makes such a statement ridiculous. Dr. Potts, who attended Goodhue, has left us the following statement of the case:

"You will see by the papers an account of a fight between Goodhue and young Cooper. The *Chronicle* today gives a long one sided account of the affair, and as old Jim is on his back and unable to write an account of the affray himself, some of his friends intend writing a short description of the affair and support it by a few affidavits. He shot Cooper above the bone of the pelvis and Cooper stabbed him in two places, one far back on the left side and the other about a half inch from the navel. Both wounds bled a great deal and gave people the impression that he was mortally wounded, and indeed he was under that conviction himself even after I had told him that neither of the wounds had penetrated any of the cavities. The morning after the affray he took a small dose of oil, and anxiously waited for the operation of it to find out whether the communication had been cut off. After it had operated he said, 'he was satisfied now that there was a communication between both ends yet' . . ."

(Dr. Potts to H. H. Sibley, then in Washington, Jan. 21, 1851.)

Reference may here be made to another misstatement concerning Goodhue. It is said in most accounts of him that he was buried somewhere on Dayton's Bluff. Actually, he was buried in Oak Hill Cemetery, which was organized the year of his death, and was situated between the present Mackubin and Western Avenues, on the west and east, and between Front and Maryland Streets on the north and south. This cemetery was soon abandoned and his remains were transferred in 1857 to Oakland Cemetery.

1852

There were now eleven physicians in Saint Paul. Dr. Sweney in January had associated with him a Dr. Abraham Hull, and the two men opened an office on St. Anthony Street over Sloan and Farrington's store (between Franklin and Washington). They advertised their services and also "an assortment of pure medicines for sale." Dr. Goodrich moved his office to the Saint Paul Drug Store (3rd and Cedar). Dr. Potts' announcement remained the same as it was in 1849. Either he was satisfied with Forbes' store for an office or he was careless in not changing his card in the paper. In the *Pioneer* under date of March 19 appears the following item:

"Hospital—In the rear of the American House, Mr. Rey, firm of Rey and Farmer, and Dr. Carlios, an eminent Medical and Surgical Practitioner from Paris, are laying the foundation of an extensive Hospital, upon ground given for the purpose by H. M. Rice, Esq."

This was the first promise of a hospital, but the plan seems not to have been executed. The records of the Abstract Office do not show that the land in question was ever transferred to the aforesaid gentlemen, and it is unlikely that the hospital was ever built, although Carlios rented Vital Guerin's house for his patients pending the completion of it. In May Drs. Hull and Sweney withdrew their card from the paper; presumably Hull left town. He may have been Dr. Abraham B. Hull, of Marietta, Ill., who was the preceptor of both Dr. Sweney and Dr. J. H. Murphy. There was no divorce law in Minnesota at this time. The legislature passed a bill granting A. Hull a divorce from his wife, Julia A. Hull. Governor Ramsey vetoed the bill on February 2, 1852. Presumably this was Dr. Hull. Late in the year Dr. Sweney went to Red Wing, where he remained till his death, August 12, 1882. In July Dr. Charles Ludwig Vicchers came to Saint Paul and opened an office on the corner of Fourth and Robert Streets, over Cathcart's and Tyson's store. In June Dr. French's advertisement was withdrawn. In May there were unclaimed letters in the post office for Dr. Hendee and Dr. Wm. Lewis. Probably they were connected with Owen's Geological Survey; at least there were unclaimed letters at Fort Snelling in 1849 for Dr. Lewis and Dr. B. E. Shumard, both of whom were connected with the survey. Shumard became a professor of obstetrics in a medical school in St. Louis, and in later years attained fame both as a geologist and as a physician.

Another dentist, G. W. Biddle, of Pittsburgh, located in Saint Paul in May, and Mrs. Biddle announced she would give instruction on the pianoforte. They established themselves at Hill and St. Anthony Streets. Biddle later bought some land above the present Seven Corners that had been preëmpted before the land was released by the government. Complications arose when someone staked out a claim on the property. This same predicament occurred to others; and they therefore organized for mutual protection to keep newcomers off. The organization was known as the Fort Snelling Claim Association. Biddle later located in Springfield, Illinois, and numbered among his patients Abraham Lincoln and his family. After several changes of residence and occupation he settled in Sparta, Illinois, where he was living in 1904, aged seventy-five years. In August, 1852, Dr. McLaren of Fort Snelling was ordered to Jefferson Barracks at St. Louis, and Dr. Ames, "a physician of excellent repute" of "All Saints" (Minneapolis), took his place as contract surgeon. In August, also, the Common Council of Saint Paul appointed a committee "for the purpose of investigating the facts connected with the appearance and progress of the smallpox in our city." The committee called in Drs. J. H. Day and Carlios, and made a canvass of all cases. They reported that the disease had made its appearance about two months previously, but that it was mild in form, and was not to be considered epidemic. There had been no new

cases, they said, for two weeks. Of the twelve cases, eleven were now convalescing satisfactorily; one death was recorded, of "an infant previously afflicted with the measles." The Committee recommended care in the reporting of cases and stated that "a suitable place has been secured by the Board for the reception of patients." This place is said to have been a house at some place toward Fort Snelling from the present Seven Corners, but definite facts are not now available.

In August, or early September, Dr. Thomas Theodore Mann arrived from La Pointe, Wisconsin. He travelled by canoe through the Brule and St. Croix rivers to Stillwater, the immemorial route of the Indians from the Great Lakes to the Mississippi. An elaborate announcement of his intention to practice in Saint Paul appeared in the *Pioneer* for October 7, 1852:

Dr. Mann

Of Philadelphia offers his services, professionally to the citizens of Saint Paul. Residence at Mrs. Ford's, Fort Street, near the residence of the governor. Being a stranger in Saint Paul, Dr. M. bespeaks a share of their confidence, by presenting the following cards from men of eminence and distinction, furnished some years since in reference to a surgeoncy in the U. S. Army.

* * *

From Governor Shunk:

Hon. W. L. Marcy—Sir: Permit me to join his other friends in commending to your consideration the application of Dr. T. T. Mann for appointment of Surgeon. Dr. Mann's private worth and professional skill are amply sustained and show that his appointment will be a just recognition of his merits.

Yours very respectfully

Harrisburg, Nov. 23, 1846 (Signed) F. R. Shunk

* * *

From Col. James Page, Col. W. E. Patterson and others:

To the Hon. W. L. Marcy, Secretary of War: Dear Sir: We the undersigned being fully convinced that the professional standing of Dr. T. T. Mann, richly qualifies him for the commission of a Surgeoncy to one of the volunteer regiments, raised under Act of Congress passed at the last session, do most cordially unite in recommending him to your favorable notice as a gentleman of skill and experience, and who we believe would make an efficient medical officer. We shall be most happy to hear of his appointment.

(Signed) James Page, Richard Vaux, H. S. Patterson, M.D.
W. E. Patterson, Geo. McClellan, M.D., Washington Atlee, M.D.
W. R. Grant, M.D.

* * *

From Prof. Geo. McClellan, the most distinguished of American Surgeons:

From a long personal acquaintance I feel great pleasure in uniting with the above gentlemen in recommending Dr. Mann to the Commission he solicits.

(Signed) Geo. McClellan, M.D.

This announcement appeared again one week later (October 14). Anyone familiar with the history of Philadelphia will recognize the names of these men as very prominent either socially or professionally. Richard Vaux, known as "Dickie" Vaux, is said to have been the only American civilian who ever danced with Queen Victoria. In the late autumn Dr. Carlios' notice disappeared from the paper. In the same month Dr. Samuel Willey arrived in Saint Paul and almost immediately went into partnership with Dr. Brisbine; both were from Ohio. Their office was on St. Anthony Street, three doors below the American House.

Two physicians were married in Saint Paul during the year. Dr. Pugsley of Wisconsin, perhaps the first physician to be married in Saint Paul, took as his bride Miss Emeline Brewster. The service was held on June 10, 1852. On November 10 the Rev. Timothy Wilcoxson united in marriage Dr. C. L. Vicchers, a German physician, and Miss Anna Coulter.

(To be continued in the next issue)

EDITORIAL

MINNESOTA MEDICINE

OFFICIAL JOURNAL OF THE MINNESOTA STATE MEDICAL ASSOCIATION

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BUSINESS MANAGER
J. R. BRUCE

Volume 21 NOVEMBER, 1938 Number 11

The Significance of the Apical Systolic Murmur

A SYSTOLIC murmur heard at the heart apex is not an uncommon finding in routine examination. Few physicians find them as frequently as Reid and Fahr, who have reported an incidence of 20 and 35 per cent in normal youthful patients.

At the turn of the century and even as late as the onset of the World War this finding was generally considered indicative of valvular heart disease and a student was frequently prohibited from strenuous athletics or a recruit was refused enlistment on this account alone.

Mackenzie was among the first to emphasize the importance of the functional capacity of the heart rather than the presence of murmurs and expressed the opinion that the presence of a systolic apical murmur in a normally functioning heart without enlargement or arrhythmia did not indicate organic valvular disease.

Cabot called attention to the rarity of uncomplicated mitral regurgitation in routine autopsies and does not believe that pure mitral insufficiency can be diagnosed during life. Personally we question the possibility of absolutely ruling out the presence of a slight leak in the mitral valve by autopsy examination.

Gradually the profession has come to accept Mackenzie's view of the significance of the apical systolic murmur. However, other factors than just the heart findings should be taken into consideration in evaluating a given case.

An analysis by Finberg and Steuer* of 100 youthful patients presenting a systolic apical murmur and observed over a period of years, is of interest. These were normal individuals except for the presence of the systolic murmur and except that 30 per cent of them showed a heart shadow over 50 per cent of the chest diameter on orthodiagraphic examination. Without going into details of the analysis, they concluded that the presence of the murmur in children under five years of age is not significant; that in youngsters with a systolic murmur and a history of rheumatic fever or chorea there is a 50 per cent chance of the development of mitral stenosis, aortic regurgitation or both; that in the 30 per cent showing heart enlargement some 40 per cent developed later serious valvular trouble; that a slight elevation of temperature (99 to 100) occurred in 70 per cent of the cases and proved of no prognostic value as to the later development of serious heart disease; that mitral stenosis or aortic regurgitation appeared on the average three or four years after first observation; and that in only eight instances did the murmur disappear. Recently the same authors† reported the observation for over ten years of thirty-five of the original 100 patients without the discovery

*Finberg, M. H., and Steuer, L. G.: Apical Systolic Murmurs in Children. Am. Heart Jour., 7:553, (June) 1932.

†Steuer, L. G., and Finberg, M. H.: Further Observations on Apical Systolic Murmurs in Children. Am. Heart Jour., 16:351, (Sept.) 1938.

of any new cases of mitral stenosis or aortic regurgitation.

The development of twenty-nine cases of mitral stenosis or aortic regurgitation or both in these 100 observed patients proves definitely that the group was not a normal one to begin with. Disregarding the twelve of the thirty patients with fluoroscopic evidence of heart enlargement who eventually developed mitral stenosis or aortic regurgitation or both, the number (17 per cent) that developed severe heart disease is still much too high for a normal group.

The conclusions drawn by the authors from this study are that as a group children with systolic apical murmurs are more likely to develop serious valvular disease. The statistical source of these authors might explain the apparent importance of a physical finding not commonly regarded as significant.

Biographic Data

PERUSAL of the files of most county medical societies would disclose a dearth of recorded information regarding present and past members. Attention is called to the situation in an article by Dr. Monte C. Piper entitled Authentic Biographical Data, which appears in this issue. Dr. Piper is the author of a new application for membership form which has been adopted by the Council of the State Association for use by all new members. This form is much more complete than the forms usually used by county societies, and its adoption gives uniformity to the information tabulated in all counties in the state. The form is made out in duplicate, one copy being filed by the local county and the other by the state office. Some counties have sent this form out to all county society members with the request that they be filled out for record purposes. Strange to say, many have neglected and some have even declined to fill out and return the forms. This is a thoughtless attitude when one considers the good reasons for the request.

We think Dr. Piper's suggestion that supplementary blanks be filled out periodically, is a good one. There is little space in the new application forms for information regarding a member's activities since graduation. If every five years a supplementary form were filled out giving information such as teaching positions, articles published, society and staff membership, postgraduate studies, specialization, additions to the family, children studying or practicing medicine, there would be on file a gold mine of authentic information which would be available for various purposes.

One of the minor uses of such a file would be its use in the preparation of life sketches for publication on the death of a member. Too often the information available is a newspaper clipping or very scanty information supplied by a relative.

How scant is the available information about most of the pioneers. Such a store of reliable information would be of inestimable value to future medical historians.

One does not have to have any particular flare for medical history in order to derive considerable pleasure from looking over what meager biographical information is to be found in the files of the county societies.

It is to be hoped that a systematic effort is going to be made to obtain these supplementary reports and that members will coöperate by filling out the blanks already sent them, and any that may be sent them in the future.

The Saint Paul Profession and City Council

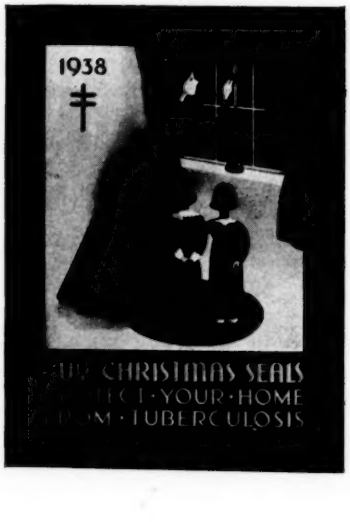
THE City of Saint Paul acts as its own insurance company in complying with the provisions of the Workman's Compensation Law regarding injuries sustained by its employes. On the grounds that certain members of the Ramsey County Society have rendered excessive bills for professional services to injured employes a threat was made a year ago by the Corporation Counsel to appoint one surgeon on a salary basis to care for all injured city employes. As a result, a committee of the Ramsey County Medical Society has been conferring with city authorities for several months in an effort to promote fair dealing and coöperation between the local profession and the city authorities. The committee offered to investigate any medical bills considered by the city to be excessive and attempt unofficially to adjust fees to the satisfaction of surgeons and city officials alike. Several bills were subsequently referred to the doctors' committee and the reductions recommended in certain cases after conference with the surgeons were as a rule agreed to.

Matters were apparently proceeding smoothly until October 4, when out of a clear sky the Council of the City of Saint Paul voted to appoint five Saint Paul surgeons to care for city accident cases on a fee basis—against the known wishes of the Saint Paul profession and also against the wishes of the city employes. Both these bodies wanted to maintain the free choice of surgeon for the individual employe.

At a special meeting of the Ramsey County Medical Society held October 12 to consider the action of the City Council a resolution was passed calling attention to the fact that this action of the City Council attempted to deprive 99 per cent of the physicians and surgeons in Saint Paul from rendering services to their patients who are city employes; that this action is not in accord with laws of the State of Minnesota, whereby an employe "should have the option or unquestioned right to choose his medical attendant or accept the one tendered him by the employer—" or as the State Supreme Court has held "the statute contains no language unconditionally requiring the latter (employe) to accept the physician tendered him or relinquish the right of reimbursement altogether. . . . The fact that the employer in this case is a municipal corporation and employs a physician for all such cases, paying him a fixed salary, cannot alter the construction given the statute." The resolution further calls attention to the fact that the Central Council of Public Service Employes has gone on record as being almost unanimously opposed to the action taken by the Council; that the members of the Ramsey County Medical Society are taxpayers and in addition furnish at no expense to the taxpayers the entire medical staff of the Ancker Hospital and the resolution declares the society opposed to such an un-American and undemocratic action that aims at the destruction of the principle of free choice of physician. It was further resolved that no member accept the appointment by the city; that the individual society members pledge themselves to continue to render services to city employes and use the services of the proper tribunals to collect fees if necessary; and that the society continue to coöperate with the city to eliminate abuses on the part of members and others in furnishing medical and surgical attention on the basis of free choice of physician by the employe.

Five surgeons were appointed by the Corporation Counsel and printed cards were distributed to employes with the names of the surgeons and instructions to patronize only the surgeons named if the employe expected his medical fees to be paid. Some, perhaps all, of the surgeons have declined the appointment and there the matter rests at the present time.

Charts prepared by the Children's Bureau at Washington showing the infant mortality in the various states for 1936, show Connecticut heading the list with 42 per 1,000 live births and Minnesota, Oregon, Nebraska and New Jersey tied for second place with 44. The rates are as a whole lower for the northern states, and Arizona, New Mexico and South Carolina had the highest mortality, 120, 122 and 81 respectively.



MEDICAL ECONOMICS

Edited by the Committee on Medical Economics
of the
Minnesota State Medical Association
W. F. Braasch, M.D., Chairman

LETTERS FROM NEEDY PATIENTS

SOME of the most illuminating and valuable information secured in the course of the Minnesota State Medical Association's Survey on Need and Supply of Medical Care has reached the State Office as a result of a newspaper appeal for information to all Minnesota newspapers, September 21.

This appeal was approved at the special meeting of county officers and delegates held in Saint Paul September 10 and released to all Minnesota newspapers September 21.

To date 200 responses have reached the State Association and each mail brings additions.

Text of News Appeal

Following is the text of the appeal:

Have you ever been deprived of a doctor's care when you needed it? What was the reason?

The Minnesota State Medical Association is now engaged in a state-wide study of medical needs in Minnesota and, in a statement issued today, asked the cooperation of patients themselves in an effort to make the study useful and complete.

Anyone who has any complaint to make or who has had any difficulty in securing medical care is asked to take part in the study by answering the above questions in a letter addressed direct to the Minnesota State Medical Association.

Communications will be kept confidential if the writer wishes and the Association will investigate the complaint and give whatever assistance is possible to the writers.

In addition, the data thus gathered will be used to round out the most complete study ever made of this much discussed problem. Upon findings, the doctors plan, according to the statement, to base recommendations for changes and improvements wherever they may seem to be needed, to the end that nobody in Minnesota may be deprived of good medical care.

Replies should be sent to the Minnesota State Medical Association, Saint Paul.

Between Restrictions

It was to be expected, of course, that a certain number of these letters would come from the chronic complainers and those who embrace all opportunities to describe their symptoms.

The great majority, however, give concrete instances of a condition suspected for some time by physicians but never before so impressively backed up by names, dates and details.

This is the condition: While people on the direct relief rolls are provided with the medical service they need — letters are conspicuously missing from recipients of direct relief—the people who are on WPA and those who are on the Old Age Assistance rolls are much too often caught between the restrictions.

In the case of Old Age Assistance, a definite provision is made in the regulations for budgeting an allowance for medical service for illnesses of a chronic or recurring nature. For emergencies the regulations definitely assign responsibility to the County Welfare Board. These regulations are clearly not recognized in a considerable number of Minnesota counties, nor are they understood by the recipients of aid.

Provided in the Law

There is, of course, no reason why these elderly people should lack medical aid in Minnesota. The law was carefully written to provide for it and the regulations adopted by the State Board of Control are explicit on the subject. It is clear, however, that missionary work is needed with county commissioners and other members of the welfare boards in a number of counties to show them their responsibility and explain to them the regulations.

The problem of medical care for WPA workers may be more difficult to solve under present regulations, but a determined effort on the part of doctors and local officials in each community should serve to create a definite understanding and a plan by which medical care can be supplied universally to these workers.

For Glasses, Dental Care

Need for glasses and dental care bulks very large in all these complaints. It is clearly very difficult for many County Welfare Boards to find funds for such non-emergent needs as these. This is a special problem for physicians, dentists, welfare boards and representatives of optical houses to work out together in each community.

In addition to the letters from those who are already recipients to some degree of some form of aid, there is a residum of letters from people who are not on the public rolls; who fear to run up doctors' bills and who are actually in serious need of medical attention. In several cases these people warmly praise their doctors, acknowledge readily that the doctor would give them the service they need if they were to apply to him regardless of their ability to pay. Nevertheless, they cannot bring themselves to ask more of that already overburdened friend.

These letters are in the minority, of course, but they should have the careful consideration of medical society representatives who investigate all these cases.

Procedure

The procedure to be followed in this investigation was outlined definitely at the special Council meeting held in Minneapolis, October 15.

Copies of the letters from each councilor district will be sent to the respective councilors and by the councilor to the officers or contact committees of the county or district society concerned.

These officers will be asked to investigate and report on each case to the councilor. Wherever advice as to official procedure would help, then the local physician will be asked to find a way to give that advice and assist the writer of the letter.

The importance of careful, sympathetic, well-considered action on each case cannot be overestimated.

Reputation at Stake

The request for information was officially ordered at the special meeting of county officers and delegates in Saint Paul, September 10. As a result, many honest appeals for aid have been made. They must be carefully and honestly answered. The reputation and honor of the Minnesota State Medical Association and its members is at stake.

GROUP HOSPITALIZATION IN MINNESOTA

Group Hospital insurance was approved in principle at the special House of Delegates meeting in Chicago. It is, of course, already established and working successfully in a good many cities, notably in Minneapolis, St. Paul and Duluth.

Requests for extension of the service have been received by the Minnesota Hospital Service Association from a number of Minnesota communities.

The question of whether or not group hospitalization can be organized and operated with equal success in the rural districts was discussed at length at a joint meeting of the Council, the Council Committee to Study Group Hospitalization and a committee from the Minnesota Hospital Service Association in Minneapolis, October 15.

No definite action was taken by the assembled group, but the hospital service representatives indicated that they will make a further study of plans for extension into rural communities and report the results to the joint committees.

Any plan of organization that may be agreed upon will be submitted to the local county or district medical society concerned before action is taken.

REACHING THE STUDENTS

The Minnesota State Medical Association will continue the college lecture courses carried on in former years under the joint auspices of the medical association and the Minnesota Public Health Association.

The importance of reaching the college group prompted arrangement of the new courses by which, at the direction of the Council, two lectures will be offered to each college each year.

A carefully selected list of subjects has been prepared under the direction of the Committee on Public Health Education and four speakers have been chosen to present each subject. College authorities will thus have the opportunity of a wide range of subjects and speakers from which to make selections.

Reaching college students who will become the teachers, professional men and leaders of the next generation, is one of the most important parts of the health education program. Lectures to students are regarded by the Council as essential to this program.

SECOND CONGRESS

Dates for the 86th Annual Meeting of the Minnesota State Medical Association are May 31, June 1 and 2.

The place is the Minneapolis Auditorium and preliminary plans outlined by the Committee on Scientific Assembly provide for a program of unique proportions.

In addition to the usual fine scientific program there will be a Second Congress of Allied Professions occupying a full day of program time. All of the allied professions including dentistry, nursing, pharmacy, social welfare, hospital administration, will participate in this program which takes on a vital importance this year, in view of new programs now under discussion for medical care.

Specific Objective

The First Congress, held in Saint Paul three years ago, provided opportunity for expression of varying points of view toward the general problems of medical care. The 1939 Congress will have a more specific objective.

The theme of the meeting as outlined at a recent gathering of the Committee on Scientific Assembly is as follows: What has Minnesota accomplished to date in each of the fields of public health and medicine? Where does each program need improvement and what form should that improvement take?

Whatever enabling legislation Congress may pass at Washington this winter, the extent and character of the program in Minnesota will depend upon the legislative and health authorities in Minnesota. Official policies are certain to be greatly influenced by the discussions at this Congress.

Health Show

A second unique feature of the Minneapolis meeting will be an extensive health show. This show will occupy the entire basement of the Auditorium and will be open to the public for the entire three days of the meeting. During the daytime, groups of children from the Minneapolis schools will be escorted through the show by arrangement with the hygiene department of the schools and Minneapolis Board of Health.

The assistance of all of the health and welfare agencies in the state is being solicited to make the show complete.

STATISTICS OR SOUND JUDGMENT

(Monthly Editorial Prepared by the Medical Advisory Committee)

Happy is the medical man who never has trouble of any kind, who is always sure of his ground, who never makes a mistake in diagnosis, and whose patients always make a 100 per cent recovery. He has either to see his first day of practice or is in retirement. Every conscientious man in active work has periods of mental depression because of his failures.

Action recently brought against a surgeon in this state and reviewed by the Medical Advisory Committee brings out the following pertinent facts:

First.—A chronic lesion can become an acute one and conversely an acute one can become chronic.

Second.—In all conditions, acute or chronic, careful taking of a history of both past and present illnesses is essential before an operation.

Third.—Examination and confirmatory diagnosis should be made by the operating surgeon within the twenty-four hours preceding surgical treatment. Even though he has full confidence in the ability of the referring physician, the consulting surgeon should make his own diagnosis in order to plan his operative procedures.

If one remembers these three facts fewer operations will be performed without justification. Moreover, less censure will be meted out to the profession because of poor results following surgical intervention.

Statistics and numbers of cases should not be a substitute for sound judgment.

MINNESOTA STATE BOARD OF MEDICAL EXAMINERS

Sheriff Beihoffer, Strong Foe of Quacks, Dies Suddenly

Alfred T. Beihoffer, sheriff of McLeod county, Minnesota, for the past twelve years, died suddenly Sunday, October 17, 1938, while pheasant hunting near Wood Lake with a number of friends. Sheriff Beihoffer, while not enjoying the best of health, the past few months, was active in his office the day before his death. He suffered a heart attack while sitting in his car and died in a few moments.

Sheriff Beihoffer was known throughout his county as a sincere, hard-working and courageous law enforcement officer. He was best known to the medical profession for the splendid coöperation he gave the Minnesota State Board of Medical Examiners in the arrest and prosecution of quacks in his county. Two of his most notable cases were the cases of State of Minne-

sota vs. Robert McGraw and State of Minnesota vs. Herman Feenstra. McGraw was a well known Negro quack who was twice prosecuted at Glenwood and escaped conviction both times. McGraw was fined and sent to jail at Glencoe and left the state after serving his jail sentence. Feenstra was arrested by Sheriff Beihoffer in August, this year, after he had disappeared and forfeited a $2,500 cash bond at Brookings, South Dakota. He was sentenced to four years at Glencoe on a charge of criminal abortion.

Sheriff Beihoffer was born July 17, 1882, in Glencoe township, McLeod county. He spent his entire life in his home county. He is survived by his widow, Mrs. Alice Beihoffer, a son, Arnold, his 85-year-old father, one brother and four sisters, including Mrs. S. E. Allen, welfare worker for McLeod county.

In addition to the tragic loss suffered by his family, the people of McLeod county and the state of Minnesota have lost a faithful public servant, and the medical profession a loyal friend, in the death of Sheriff Beihoffer.

Minneapolis Woman Found Not Guilty of Obtaining Morphine from Physicians by Fraud and Deceit

Re: State of Minnesota vs. Helen Genevieve Rudd

After deliberating more than nineteen hours, a jury in the court of the Honorable Mathias Baldwin, Judge of the District Court, Minneapolis, found Helen Genevieve Rudd not guilty of obtaining morphine by fraud, deceit and misrepresentation under the new 1937 Minnesota Uniform Narcotic Drug Act.

The defendant was arrested July 7, 1938, following a joint investigation of the matter by the Federal Bureau of Narcotics and the State Board of Medical Examiners. The defendant has been in the Hennepin county jail since that time in default of bail. About a week before her trial began, she entered a plea of guilty to the charge before Judge Day, but upon being questioned by the Court prior to being sentenced stated she was unable to state the circumstances surrounding the obtaining of the two prescriptions that were the basis of the charge. Thereupon the Court ordered the plea of guilty stricken and the case set for trial.

The case was well tried for the state by Mr. Arthur Markve, assistant county attorney. The evidence offered by the State showed that the defendant had been attended by six Minneapolis physicians from the middle of April, 1938, and June 30, 1938, a period of six weeks. She was complaining of pain that indicated to each of the physicians called that she had a kidney stone. From five of these physicians she received morphine either in the form of hypos or by prescription. She received twelve prescriptions for morphine from four different physicians in thirteen days, May 6 to May 19, also one on June 30, a total of 78¼ gr. One physician testified that he wrote a prescription on May 6 and another on May 7 after the defendant had stated to him that she had lost the first one. This was denied by the defendant; she admitted getting the prescription but denied she stated she had lost the first one.

The defendant was convicted in Federal court in Minneapolis in December, 1934, on a charge of forging and altering narcotic prescriptions. She served fourteen months in the Federal Industrial Institution for Women at Alderson, West Virginia, on that charge. She is married and lives with her husband and one daughter. At the time of her arrest this year her address was 2527 First Avenue South, Minneapolis. She is thirty-nine years of age, about 5 feet 2 inches in height and weighs about 155 pounds. She appears to be older than the age stated.

The State Board of Medical Examiners urges every physician to refrain from administering, furnishing or prescribing morphine for this woman. If a call is made for a physician, he should insist on a complete examination, including x-ray, and hospitalization, if necessary, before any narcotic is given.

ALCOHOL IN RELATION TO TRAFFIC ACCIDENTS

Richard L. Holcomb, Evanston, Ill. (*Journal A. M. A.*, Sept. 17, 1938), reports the results of a study of the drinking of drivers involved in personal injury accidents and of the drinking of drivers in the general population. The second study served as a control of the first, allowing conclusions to be drawn as to the part alcohol plays in accidents. A total of 270 persons were tested in the first study. Drivers involved in personal injury accidents who accompanied the persons injured to a hospital or drivers who themselves were injured were tested by urinalysis for alcohol. A total of 1,750 persons were tested in the second study. Drivers were chosen at random from an area comparable to that of the first study. A complete testing laboratory, with the Harger "drunkometer," was set up in a trailer, allowing breath tests for alcohol to be made immediately. 1. The highest percentage of drinking drivers occurs in the early morning hours and over the week-end. 2. The largest number of drinking drivers occurs in the early evening and over the week-end. 3. The peak age for drinking drivers is from 25 to 30. 4. Women drink and drive as much as men when the number of women driving at various hours of the day is considered. 5. The percentage of drinking drivers in the general population varies as does the percentage of drinking drivers in the personal injury accident group but falls considerably lower at all times. 6. The percentage or number of drivers involved in personal injury accidents varies as does the percentage or number of drinking drivers. 7. As the blood alcohol content increases, the number of drivers appearing in the personal injury accident group increases out of all proportion over that in the general driving population. 8. As alcohol increases, accidents increase and at a rate somewhat proportionate to the increase in alcohol. 9. Equal percentages of drinking drivers are found in the accident group and in the general population group at a point near 0.5 part of alcohol per thousand parts of blood, indicating that alcohol in that amount is not necessarily a significant cause of accidents. 10. The data gathered in this study confirms a self-evident fact, that alcohol is a major cause of automobile accidents.

OF GENERAL INTEREST

Dr. Roy A. Hoffman of Minneapolis was married on October 16 to Miss Lolita B. Wilkinson of Cloquet.

* * *

Dr. John C. Fueling of Bovey is taking a postgraduate course at Columbia University.

* * *

Dr. A. R. Ellingson of Detroit Lakes was recently elected a fellow of the American College of Surgeons.

* * *

Dr. O. F. Mellby of Thief River Falls has been named chief of staff at Mercy Hospital.

* * *

Dr. Stanley Peters of Virginia has moved to Silver Creek, N. Y.

* * *

Dr. O. H. Jones has opened offices in Madison Lake for the practice of medicine. He recently completed his interneship at St. Mary's Hospital, Minneapolis.

* * *

Dr. Carl G. Wingquist has opened offices at Crosby. He formerly practiced at Carlton, Minnesota, and Los Angeles, California.

* * *

Dr. Harold Hullsiek of Saint Paul has resumed practice following an absence of four months from his office.

* * *

Dr. George Kaiser of Saint Paul has become associated with Dr. W. E. Macklin of Litchfield. Dr. Kaiser is a recent graduate of the University of Minnesota medical school.

* * *

Dr. E. H. Hansen, formerly of Minneapolis, has opened offices in Marshall. Dr. Hansen graduated from Tulane University, and served his interneship at the City and County Hospital in San Francisco.

* * *

Dr. W. E. Richardson of Philip, South Dakota, has opened an office at Rushford, for the practice of medicine. Dr. Richardson practiced at Slayton and Pipestone, before going to Philip, South Dakota.

* * *

Dr. L. F. Hawkinson, who has been associated with the Brainerd Clinic at Brainerd, Minnesota, will leave November 15 for Oakland, California, where he will establish practice.

* * *

Dr. I. L. Oliver of Graceville was recently elected to the American College of Surgeons and attended the meeting in New York City, where he received his fellowship.

* * *

Dr. John East has located in Northome for the practice of medicine. He is a graduate of the school of medicine of the University of Oklahoma, and served his interneship at Ancker Hospital, Saint Paul.

Dr. L. J. Hoyer, formerly of Howard Lake, has located at Windom. Dr. Hoyer recently completed a postgraduate course in surgery and bone fracture at the Cook County Graduate School of Medicine at the Mayo Clinic.

* * *

Dr. D. J. Jacobson, formerly of Blackduck, has located at Bemidji, where he will continue the practice of medicine. Before leaving Blackduck, Dr. Jacobson was the guest of honor at a dinner given by the Blackduck Community Club.

* * *

Dr. Harlow B. Thompson has opened offices at Ada for the practice of medicine. He is a graduate of the medical school of the University of Oregon, and served his interneship at the Tacoma General Hospital and Pierce County Hospital at Tacoma, Washington.

* * *

Dr. Samuel T. Sandell has become associated with Dr. H. E. Binet of Grand Rapids. Dr. Sandell is a graduate of the medical school of the University of Minnesota and served interneships at Ancker Hospital in Saint Paul, and the Glen Lake Sanatorium in Hennepin County.

* * *

The American Medical Association and the National Broadcasting Company are broadcasting at 1 p. m. each Wednesday, over the Blue Network, a radio program entitled "Your Health." The program is not one of health talks, but of dramatization written and produced by radio artists prepared from information furnished by the Bureau of Health Education of the American Medical Association.

* * *

Graduate Fellowships in Anesthesiology have been established by the Medical School and Graduate School of the University of Minnesota for physicians who desire to prepare themselves for the practice of this specialty. The fellowships offer an abundance of clinical training in all types of local, regional and general anesthesia and gas therapy, and also adequate related graduate work in chemistry, anatomy, physiology, pharmacology. Applicants must have served at least one year in a rotating interneship.

* * *

The Squibb Institute for Medical Research, a new $750,000 modern building especially adapted for research, at New Brunswick, New Jersey, was dedicated with appropriate ceremonies October 11, 1938. Air conditioning and accurate control of temperature and humidity will make research possible the year around. The aim of the founders of the Institute is to create in the medical and biological fields an industry-supported research enterprise analogous to the Bell Telephone and General Electric laboratories in the sphere of physics.

Dr. Litzenberg Honored

An appreciation dinner was given in honor of Dr. Jennings C. Litzenberg on the evening of October 14, 1938, at the Minikahda Club, Minneapolis, by some 200 former pupils and friends in celebration of his completion of twenty-five years as chief of the Department of Obstetrics and Gynecology of the University of Minnesota.

Following his gradution from the University of Minnesota medical school in 1899, Dr. Litzenberg acted as assistant to Dr. L. J. Cooke, the medical director of athletics, before he specialized in obstetrics and gynecology. It was fitting that Dr. Cooke should act as Master of Ceremonies at the testimonial dinner, which he did with much display of wit and humor. After-dinner speeches were made by Dr. Lee W. Barry of Saint Paul, who outlined changes in obstetrical procedures which have taken place in the past twenty-five years; by Dr. William A. O'Brien, who wittily described a picture of Dr. Litzenberg projected on a screen and purported to be the portrait of the honored guest to be presented to the University; by Dr. John L. McKelvey, who is Dr. Litzenberg's successor as chief of the department, in which he paid graceful tribute to his predecessor, giving him a large share of the credit for the low infant and maternal mortality in Minnesota. Although not appearing on the printed program, Mr. John Powell, a life-long friend, contributed a nice tribute to Dr. Litzenberg, and all those present were amused by the witty remarks of Dr. Litzenberg's son, Carl, a professor of English at the University of Wisconsin. In responding, Dr. Litzenberg disclaimed credit for the high standing of obstetrics in Minnesota, and gave credit to the ability of his departmental staff.

The dinner, sponsored by a committee of which Dr. S. B. Solhaug was chairman, was a great success and all who attended derived great satisfaction from being able to show their appreciation of "Litz."

* * *

Dedication of Mayo Foundation House

On September 23, at Fourth Street and Seventh Avenue Southwest in Rochester, in the stone house which had been their home since 1917, Dr. and Mrs. William J. Mayo received members of the staffs of The Mayo Clinic and The Mayo Foundation in order formally to dedicate the building and grounds as Mayo Foundation House.

On the occasion, short addresses were delivered by representatives of The Mayo Foundation, The Mayo Clinic and The Mayo Properties Association. Dr. Mayo responded in part as follows:

"When my brother and I built our homes, we built them not merely for the purpose of living in them ourselves, but with the idea that they should be of such character as would make them suitable gathering places where the staff of the Clinic and the fellowship men might meet men of science from this country and abroad and cultivate those social contacts which are so important a part of professional life.

"And so with this Foundation House, which we have given over to be used for continuation and extension of educational and related social functions which are in

(Continued on Page 812)

In Memoriam

Martin C. Bergheim

1886-1938

DR. Martin C. Bergheim, Hawley, Minnesota, died October 4, 1938, of bronchopneumonia, at the age of fifty-two.

Dr. Bergheim was born in Madison, South Dakota, January 23, 1886. He graduated from St. Olaf College in 1912. The following three years he acted as principal and athletic coach at Lamberton, Minnesota. In 1916 he entered the University of Minnesota medical school and graduated in 1919, serving as interne at the Providence Hospital at Detroit, Michigan. He was a member of the Phi Beta Pi medical fraternity.

Dr. Bergheim practiced medicine at Raymond, Minnesota, for a year before locating in 1921 at Hawley, where he had since practiced. In 1922 he contracted scarlet fever and his health was permanently impaired as a result although he carried on an active practice.

A member of the Lutheran Church, Dr. Bergheim also belonged to the Masonic and Eastern Star lodges. He was a member of the Clay-Becker County Society, the Minnesota State and American Medical Associations.

Dr. Bergheim is survived by his widow; two daughters, Gail Marie and Jeanne Marie; his father, C. N. Bergheim; two brothers, Richard and Nordahl of Madison, South Dakota; and six sisters.

Dr. Bergheim's kindness and patience in dealing with his many patients will long be remembered in the community in which he lived.

F. C. Bowman

1849-1938

DR. F. C. Bowman, of Duluth, passed away on October 4, 1938, at the age of eighty-nine.

Dr. Bowman was born on a farm at Hebron, Maine, and in 1857 came to Minnesota, attending high school in Litchfield, Minnesota. In 1875 he began the study of architecture at the University of Minnesota, earning his way by working as a janitor, carpenter, assistant chemist and contractor. In 1879 he began the study of medicine at the Hahnemann Medical School.

Dr. Bowman arrived in Duluth in March, 1881, having had to pawn his watch to finance the price of a railway ticket to Minnesota. The first few months of practice in Duluth were difficult and it was only through the assistance of Luther Mendenhall, a pioneer Duluth banker, that he was able to continue practice.

During the more than half century of practice in Duluth, Dr. Bowman was active in civic affairs. In the late 1880's he was a member of the Board of Education of Duluth, and in the 1890's was a member of the State Board of Medical Examiners.

Dr. Bowman was a member of the First Methodist Church and of the Scottish Rite of Duluth, and also

of the Golden Fleece lodge, A. F. and A. M. of Litchfield. For many years he was a member of the Saturday Lunch Club also. He is survived by his widow; a daughter, Mrs. L. H. Jones of Coral Gables, Florida; two sons, Lawrence and Leslie, of Duluth.

Henry Martyn Bracken

1854-1938

DR. Henry Martyn Bracken, former Secretary of the Minnesota State Board of Health and a resident of Minneapolis from 1885 until 1923, died at his home in Claremont, California, September 25, 1938, at the age of eighty-four.

Dr. Bracken was born February 27, 1854, the son of a physician and as a boy lived in Jersey, Ohio, where he received his preliminary education except for a year at Elders Ridge Academy. He taught in a summer school at the age of seventeen and then returned to the Academy, where he graduated in 1872, delivering a Greek oration. His father died the same year and he returned to teaching at Boonton, New Jersey, but in 1874 entered the medical department of the University of Michigan for a year. After teaching another year he entered the College of Physicians and Surgeons, New York, where he graduated in 1877.

Following graduation Dr. Bracken went to Venezuela as mine surgeon, but shortly left for Edinburgh for further medical study and in 1879 passed the examination of the Royal College of Surgeons. After spending the summer as physician in a boys' boarding school at Uppingham-by-the-Sea, he sailed as ship surgeon on the "Moselle" to Central and South America and the West Indies. During the three years as ship surgeon he contracted both yellow fever and malaria.

In the fall of 1882, Dr. Bracken returned to practice in a New England town, but being dissatisfied went to Sonora, Mexico, in 1884, as camp surgeon in a mining camp. Owing to the activities of the Apaches under Geronimo, the mines closed in 1885 and Dr. Bracken returned to New York for more postgraduate study. In December, 1885, he came to Minneapolis with his wife whom he had married in 1884 before going to Mexico.

Upon organization of the Medical School of the University of Minnesota in 1887, Dr. Bracken was appointed Professor of Materia Medica and Therapeutics and lectured also on Public Health and Preventive Medicine. He remained on the faculty until 1907 when he resigned to devote his time to the State Board of Health. He was elected to this board in 1895 and became its Secretary and Executive Officer in 1897, succeeding Dr. Charles N. Hewitt. During his incumbency, which lasted until 1919, the present divisions of the board, with the exception of the Division of Child Hygiene, were created. The mortality from typhoid, diphtheria, and the other contagious diseases of childhood and also from tuberculosis were unbelievably high at the turn of the century and proved a serious problem in State Board activities. Dr. Bracken was particularly concerned with the care of lepers in Minnesota and was instrumental in the establishment of a national leprosarium. He took a leading part in national health affairs and in 1912 was president of the Conference of State and Provincial Health Authorities of North America.

In 1916, Dr. Bracken volunteered his services to the medical corps of the British Navy but was not accepted on account of his age. Again in 1917, he volunteered his services to the Medical Corps of the United States Army, but was considered of much greater value in his official position. On September, 1919, he retired as State Health Officer and was commissioned as surgeon in the Reserve Corps of the United States Public Health Service and was assigned to the Veterans' Bureau. In 1923, he resigned and moved to Claremont, California, where he maintained his interest in Public Health, lecturing at Pomona College, and making a thorough review of the official records of the Minnesota State Board of Health from 1872 through 1936.

Dr. Bracken took an active part in the American Medical Association's public health program, was a member of the first Board of Directors of the National Tuberculosis Association, and in 1906 organized the Minnesota's Association for the Prevention and Relief of Tuberculosis, now the Minnesota Public Health Association. He also organized the Minnesota State Sanitary Conference and was its secretary.

A few years ago Dr. Bracken returned for a visit with his nephew, Dr. William Henry Condit of Minneapolis. At this time he appeared hale and hearty, attended with Dr. Chesley, present secretary of the State Board of Health, several county society meetings, and enjoyed meeting many of his old friends. Besides his nephew, Dr. Condit, Dr. Bracken is survived by his widow.

John Folta

1901-1938

DR. John Folta of Ceylon, Minnesota, died suddenly from coronary thrombosis at the home of his brother, Andrew Folta, in Minneapolis, on October 14, 1938.

Dr. Folta was born in Morrison County, Minnesota, in 1901, the son of Adam and Anna Folta, his parents being natives of Austria. At the age of sixteen he entered Baldwin-Wallace College near Cleveland, Ohio, and later Berea College, where he received his B.A. degree in 1923. He received his M.D. degree at the University of Minnesota Medical School in 1929, and after serving one year as interne in St. Luke's Hospital, Duluth, he became associated with Dr. Arnt G. Anderson, Minneapolis, for a year.

Dr. Folta began practice at Ceylon in 1930 and the

following year purchased the practice and hospital of Dr. Bailey when the latter moved to Fairmont. Since July, 1937, Dr. I. Fisher had been associated with him in practice.

In 1930 Dr. Folta married Dorothy Thompson of Duluth. He is survived by his widow; two sons, Russell, aged 6, and Richard, aged 3; his father, three brothers and a sister.

Dr. Folta was keenly interested in athletics, having played football in his student days, and had gone to Minneapolis chiefly to attend the Minnesota-Michigan game. He was a member of the Masonic Lodge of Sherburn, the Blue Earth Valley Medical Society, Minnesota State and American Medical Associations.

Albert Henry Parks

1880-1938

DR. Albert Henry Parks was born in Battle Creek, Michigan, April 15, 1880, the son of Reuben B. and Celia Burr Parks. He was graduated from the Battle Creek High School in 1898 and after two years at Albion College he entered the University of Michigan, where he graduated June 25, 1904, receiving a Bachelor of Arts degree. He received his M.A. and M.D. degrees from Northwestern University in 1906. After serving his internship in St. Luke's Hospital, Chicago, he was licensed to practice in the State of Minnesota on April 12, 1907 and in California, February 23, 1922.

Dr. Parks was a member of the Hennepin County Medical Society, Minnesota State Medical Association, American Medical Association, Sigma Chi Fraternity, and the Phi Beta Pi Fraternity.

During the period from 1908 to 1915 when Dr. Parks was assistant city physician, Hopewell Hospital for tuberculous patients was opened and he was put in charge of the medical treatment of these patients, also acting as superintendent of the institution.

He was a founder and first president of the Lake Harriet Commercial Club, a founder and first president of the Lake Harriet Lodge A. F. and A. M. 277; and from 1910 to 1911 was national president of the Phi Beta Pi medical fraternity.

In 1913 and 1914 he served as alderman of the 13th Ward, resigning in 1915 to give his attention to practice.

In June 1917 he was appointed a member of the local draft board of the 13th Ward of Minneapolis. In June 1918 he resigned and on August 1 was commissioned captain in the Medical Section of the Officers' Reserve Corps, receiving his honorable discharge on April 15, 1919.

Dr. Parks was appointed chief of the Surgical Service, Division "B" of the General Hospital Staff, Minneapolis, January 14, 1918. He was a member of the Staff of St. Barnabas Hospital for five years and was a member of the Surgical Staff of Asbury Hospital from the beginning of his practice until his retirement, serving as Chief of Staff during the year 1932. The last years of his surgical practice were spent here, where he endeared himself to the hospital personnel and to the staff of doctors. He was appointed a member of the Board of Public Welfare during the year 1923.

The following articles were written by him:

Among his written contributions may be listed: The Medico Legal Expert, written for the Medico Legal Journal; Brotherhood, written for the Phi Beta Pi Quarterly; and Economic Therapeutics, read before the Asbury Hospital Staff and the Hennepin County Medical Society and published in Minnesota Medicine in 1932.

Dr. Parks was married to Katherine Barrett, a graduate nurse from Abbott Hospital, Minneapolis, on September 1, 1909. Their only child is a daughter, Mrs. Jean Parks Forrest of Minneapolis.

Dr. Parks used unusual foresight in preparing himself for his profession, obtaining his B.A., M.A., and M.D. degrees and serving his internship in one of the leading hospitals. When he began to practice in the City of Minneapolis he continued to reëducate himself by his association with the General Hospital. He carried out a program for the young physician that was ideal. In his private practice from the very beginning there was ample evidence of his good preparation and that he was applying the highest ethical principles of medical practice.

Dr. Parks felt, also, a civic duty which was shown by his willingness to serve the public hospitals, the public welfare board, and the city council.

He was devoted to his family and knowing that the condition of his health might separate them without warning, he, as long ago as 1929, wrote and sealed a farewell message to his wife and daughter, paying beautiful and well deserved tribute to them both. He died August 30, 1938, after an illness of five years.

One of Dr. Parks' outstanding characteristics was his praise of others and his personal modesty. Another virtue was his great generosity. He will be remembered for his gracious manner, his thoughtfulness of others, and his pleasant companionship, as well as for his painstaking care of his patients and his scientific attainments.

Dr. Parks was a colorful figure in his profession, a clever surgeon, an astute diagnostician, and an ideal consultant. My association with him in surgery at Asbury Hospital during his last active years was an inspiration.

CLAUDE C. KENNEDY.

OF GENERAL INTEREST

Mayo Foundation House

(Continued from Page 810)

the best interest of the purposes of the Foundation. This house was built with the intention of such ultimate use: fireproof, of large size, suitable for the development of the opportunities which we hope will be realized."

The donors have provided a sufficient endowment for maintenance of the house and garden and have taken up their residence in a new and smaller dwelling. Their former home, now Mayo Foundation House, already is in daily use as a meeting place for seminars and for other groups engaged in educational activities.

REPORTS and ANNOUNCEMENTS

MEDICAL BROADCAST FOR NOVEMBER

The Minnesota State Medical Association Morning Health Service.

The Minnesota State Medical Association broadcasts weekly at 11:00 o'clock every Saturday morning over Station WCCO, Minneapolis (810 kilocycles or 370.2 meters) and Station WLB, University of Minnesota (760 kilocycles or 395 meters).

Speaker: William A. O'Brien, M.D., Associate Professor of Pathology and Preventive Medicine, Medical School, University of Minnesota. The program for the month will be as follows:

November 5 Good Posture.
November 12 Gall Bladder Disease.
November 19 Sinusitis
November 26 Development of Teeth.

SCIENTIFIC EXHIBIT AMERICAN MEDICAL ASSOCIATION

Application blanks are now available for space in the Scientific Exhibit at the St. Louis Session of the American Medical Association, May 15-19, 1939. Attention is called to the fact that the meeting is a month earlier than usual, and applications close January 5, 1939. Blanks will be sent on request to the Director, Scientific Exhibit, American Medical Association, 535 North Dearborn St., Chicago, Ill.

PAN-PACIFIC SURGICAL ASSOCIATION

The third Congress of the Association will be held in Honolulu, September 15 to 28, 1939. An invitation is extended to all surgeons in the State Association to take part in this meeting, which will be attended by outstanding surgeons from Australia, New Zealand, China, Japan, Java, Canada and the United States. There will be sections on fractures and orthopedics, general surgery, gynecology, neurosurgery, ophthalmology, otolaryngology, plastic surgery, thoracic surgery and roentgenology. A visit to the "Paradise of the Pacific" is an additional attraction. Dr. Forrest J. Pinkerton, Young Building, Honolulu, is secretary of the Association.

NORTH DAKOTA SOCIETY OF OBSTETRICIANS AND GYNECOLOGISTS

The biannual meeting of the North Dakota Society of Obstetricians and Gynecologists was held Friday, October 28, at the Fargo Country Club, Fargo, North Dakota.

Dr. W. F. Mengert, of the University of Iowa Medical School, spoke on "Toxemias of Pregnancy" and Dr. J. C. Litzenberg, Emeritus Professor of the Department of Obstetrics and Gynecology of the University of Minnesota, addressed the meeting. Case reports were presented by Drs. J. F. Hanna, G. W. Hunter, B. M. Urenn and J. R. Dillard.

Officers for the ensuing year are: Dr. J. F. Hannar, Fargo, president; Dr. John H. Moore, Grand Forks, vice pesident; and Dr. A. C. Orr, Bismarck, secretary-teasurer.

SCOTT-CARVER SOCIETY

At the Scott-Carver Medical Society meeting held in Montgomery, October 11, Dr. George Eitel, Minneapolis, spoke on "Traumatic Surgical Emergencies," and Dr. Ernest Meland, Minneapolis, talked on "Urological Emergencies."

WABASHA COUNTY SOCIETY

The seventieth annual meeting of the Wabasha County Medical Society was held at Wabasha, Thursday afternoon and evening, October 6, 1938.

At the business session, the following officers were elected for the coming year:

President—Dr. B. J. Bouquet, Wabasha
Vice President—Dr. E. W. Ellis, Elgin
Secretary-Treasurer—Dr. W. F. Wilson, Lake City
Delegate to State Association—Dr. E. C. Bayley, Lake City
Alternate—Dr. R. H. Frost, Wabasha
Censor for three years—Dr. G. W. Holt, Wabasha
Censors continuing in office—Dr. J. R. Slocumb, Plainview, and Dr. B. A. Flesche, Lake City.

One new member was received into the society, Dr. Robert A. Glabe of Plainview.

Dinner was served at Hotel Anderson through the courtesy of the Wabasha members. Among the guests were Dr. A. J. Chesley and Dr. R. N. Barr of the Minnesota Department of Health, and Dr. Roy Flannagan, of Richmond, Virginia, liaison officer of the relief forces of that state. Upon invitation, each of these guests made a few appropriate remarks.

At the scientific session in the evening, the following program was presented:

President's Address—"Coöperation Within the Society"—Dr. H. T. Sherman, Plainview.

"Epidemic Encephalitis"—Dr. Gordon R. Kamman, Saint Paul.

"Granulocytopenia, With Case Reports"—Dr. B. A. Flesche, Lake City.

"Practical Points in Pediatric Practice"—Dr. Edward Dyer Anderson, Minneapolis.

"Roentgen Therapy in Malignant Disease"—Dr. W. C. Popp, Mayo Clinic, Rochester.

The Women's Auxiliary held their sessions in connection with this meeting. Entertainment for the ladies was provided at the home of Dr. and Mrs. Ochsner.

In all, there were thirty-two in attendance, including nineteen physicians, three dentists and ten doctors' wives.

WASHINGTON COUNTY

The regular meeting of the Society was held September 13. A report was given by Dr. E. V. Strand,

Bayport, and by the secretary of the State House of Delegates meeting held in Saint Paul, September 11.

The scientific program was given by Dr. Gordon R. Kamman, Saint Paul, who devoted most of his time to a consideration of vitamins and then discussed some recent experiences with acute encephalitis.

Dr. Leo James Conlin, Lake Elmo, was elected to society membership.

* * *

The guest speaker at the meeting held on October 11 was Dr. Raymond N. Bieter of the Medical School, who spoke on "The Chemistry and Therapeutic Use of Sulfanilamide."

The booklet on Maternal Care and Complications edited by Dr. Fred Adair and distributed by the Minnesota State Department of Health through Dr. Chesley, was given to the society members.

Mr. Manley Brist of Saint Paul was a welcome guest.

WOMAN'S AUXILIARY

Mrs. W. B. Roberts, President
2735 Irving Avenue South, Minneapolis.
Mrs. E. V. Goltz, Press and Publicity, St. Paul, Minn.

Mrs. William B. Roberts, State President of the Women's Auxiliary of the Minnesota State Medical Association, was the guest delegate of the Auxiliary to the northern Minnesota district August 29 and 30, which was held in Crookston. The Northern Minnesota District Medical Society met at that time and members of the Auxiliary were entertained delightfully by the members of the Auxiliary of the Red River Valley Medical Association. Women from various parts of the northern territory of Minnesota attended and special guests besides Mrs. Roberts were Mrs. E. M. Hammes and Mrs. George Earl of Saint Paul. Mrs. Roberts was the house guest of Mrs. J. F. Norman, past president of the State Auxiliary. An attractive luncheon was held at the Hotel Crookston for the visitors, and Mrs. Roberts addressed the group. Following the luncheon a tour was arranged for the visitors, taking in the interesting points of the city and community. Later in the afternoon a bridge-tea was held at the home of Mrs. O. E. Locken. Honors in bridge were won by Mrs. Clarence Jacobson, Mrs. H. H. Hodgson and Mrs. Roberts. Presiding at the tea table, which was attractively arranged with zinnias, were Mrs. C. L. Oppegaard and Mrs. B. Borreson of Thief River Falls. Mrs. C. L. Oppegaard was the social chairman and was assisted by Mrs. G. A. Morley and Mrs. C. G. Uhley (registration); Mrs. O. L. Bertelson and Mrs. M. O. Oppegaard (transportation); Mesdames Hodgson, L. L. Brown, O. K. Behr, R. O. Sather and B. Borreson of Thief River Falls (luncheon); and Mesdames J. F. Norman, W. G. Paradis, W. F. Mercil, S. H. Stuurmanns of Erskine and Mrs. O. E. Locken of Crookston (bridge-tea). In the evening the doctors and their wives enjoyed a dinner together. The Red River Valley Auxiliary is noted for its hospitality and sociability, and Mrs. Roberts reports a most interesting and enjoyable meeting.

The members of the Woman's Auxiliary to the Clay-Becker Medical Society had their regular summer meeting, August 15, when the Clay-Becker Medical Society convened. A joint dinner was held at the Pettibone Lodge, which was followed by a talk by Dr. J. M. Hayes, who spoke of the work done by the organization, and also on the technical subject "Gallbladder Diseases." The business session of the Auxiliary was devoted mainly to philanthropic plans for the coming winter. Attending from Detroit Lakes were Mrs. L. H. Flancher, Mrs. Arnold Larson, Mrs. O. O. Larsen and Mrs. A. R. Ellingson; from Hawley, Mrs. C. W. Simison, Mrs. V. D. Thysell and Mrs. M. C. Bergheim. After the business session cards were enjoyed by the members.

Mrs. Roy Andrews, a member of the Blue Earth County Auxiliary, attended the annual American Medical Association meeting in San Francisco.

On September 26 the Woman's Auxiliary of the Minnesota State Medical Association held its first Executive Board meeting at the Minikahda Club, Minneapolis, at 10:30 a. m. Mrs. William Roberts, the president, presided. Reports of the county presidents were read and the activities for the year discussed. Following the meeting a luncheon was served at the club with Mrs. Charles C. Tomlinson of Omaha, Nebraska, president of the Women's Auxiliary of the American Medical Association, the honored guest. Dr. J. M. Hayes, president of the Minnesota Medical Association, spoke. Following the luncheon Mrs. J. M. Hayes was hostess at a beautifully arranged tea for the visitor, at her home, 2821 Benton Boulevard. Mrs. Martin Nordland of Minneapolis was the social chairman.

The Woman's Auxiliary of the Mower County Medical Society held its fall meeting October 3 at the Austin Country Club. Thirteen members and four guests were present and luncheon was served at one o'clock followed by a business meeting. Mrs. Paul Robertson, president, presided and gave a report of the state board meeting held in Minneapolis September 25. Bridge followed and prizes were won by Mrs. Paul Leck and Mrs. G. E. Hertel. Out-of-town guests were Mrs. A. E. Henslin of LeRoy and Mrs. J. M. Thomson of Brownsdale The next meeting will be October 31.

A tea held at the home of Mrs. Edward Schons, Saint Paul, September 26, honored the national president of the Woman's Auxiliary, Mrs. Charles C. Tomlinson of Omaha. The tea was given by the members of the Ramsey County Women's Auxiliary.

BOOK REVIEWS

Books listed here become the property of the Ramsey and Hennepin County Medical libraries when reviewed. Members, however, are urged to write reviews of any or every recent book which may be of interest to physicians.

YOU CAN SLEEP WELL. Edmund Jacobson, M.D. 269 pages. Illus. Price, cloth, $2.00. New York: McGraw-Hill Book Co., Whittlesey House, 1938.

CANCER OF THE BREAST AND CANCER OF THE UTERUS. By Marion Ellsworth Anderson, M.D. 63 pages. Illus. Paper cover. Clinton, Iowa: Franklin Press, 1938.

EXPERIENCES IN THE MANAGEMENT OF FRACTURES AND DISLOCATIONS. Based on an analysis of 4,390 cases. By the Staff of the Fracture Service of the Massachusetts General Hospital. Philip D. Wilson, M.D., General Editor. 1036 pages. Illus. Price, cloth, $15.00. Philadelphia: J. B. Lippincott & Co., 1938.

ANUS, RECTUM, SIGMOID COLON. Diagnosis and Treatment. By Harry Ellicott Bacon, B.S., M.D., F.A.C.S., F.A.P.S. Assistant Professor of Proctology, Temple University School of Medicine; Assistant Professor of Proctology, Graduate School of Medicine, University of Pennsylvania; Visiting Proctologist, St. Luke's and Children's Hospitals, etc. 855 pages. Illus. Price, cloth, $8.50. Philadelphia: J. B. Lippincott & Co., 1938.

A HISTORICAL CHRONOLOGY OF TUBERCULOSIS. Richard M. Burke, M.D., State Veterans Hospital, Sulphur, Okla. 84 pages. Price $1.50, cloth. Springfield, Illinois: Charles C. Thomas, 1938.

THE 1938 YEAR BOOK OF PHYSICAL THERAPY. Richard Kovacs, M.D., Editor. Clinical Professor and Director of Physical Therapy of New York Polyclinic Medical School and Hospital; Attending Physical Therapist Manhattan State, Harlem Valley State and West Side Hospitals, etc. 486 pages. Illus. Price, $2.50, cloth. Chicago: Year Book Publishers, 1938.

PRACTICAL MICROBIOLOGY AND PUBLIC HEALTH. William Barnard Sharp, S.M., M.D., Ph.D. Professor of Bacteriology and Preventive Medicine, Medical Department of the University of Texas; Visiting Bacteriologist John Sealy Hospital, Galveston, etc. 492 pages. Illus. Price $4.50, cloth. St. Louis: C. V. Mosby Co., 1938.

ENDOCRINE THERAPY IN GENERAL PRACTICE. Elmer L. Sevringhaus, M.D., F.A.C.P. Professor of Medicine, University of Wisconsin; Editor Department of Endocrinology, Year Book of Neurology, Psychiatry and Endocrinology. 192 pages. Illus. Price, $2.75, cloth. Chicago: Year Book Publishers, 1938.

ALLERGIC DISEASES: THEIR DIAGNOSIS AND TREATMENT. By Ray M. Balyeat, assisted by Ralph Bowen. Illustrated with 132 engravings, including 8 in colors. 4th ed., rev. and enl. $6.00. Philadelphia: F. A. Davis Co., 1936.

In writing this book the author seems to have had in mind a manual for allergic patients. However, much of the text seems to be more scientific and more specialized than most laymen would be able to understand. For the professional man the book contains a large fund of information, but there is much of it that is simpler than a physician needs. There is a wealth of information in this book, but it is not as available as it should be either for the doctor or for the patient. Many of the points are illustrated with case histories, which is not good for laymen, as it serves as a patent medicine advertisement. There is advice given in this book which does not seem in agreement with the feeling of the profession as a whole; i.e., birth control is recommended for people with migraine as a means of preventing it in the offspring. This seems to a reviewer as radical treatment for a condition that is an inconvenience rather than a disease. On the whole this volume is not particularly recommended either for the patient or for the professional man.

DIABETES; A MODERN MANUAL. Anthony M. Sindoni, Jr., M.D. 240 p. charts, $2.00. New York: Whittlesey House, 1937.

This book is put out primarily to teach the diabetic patient how to take care of himself while under a physician's care. The material is well written and in simple language so that the intelligent diabetic individual can understand it. The section containing answers to typical questions asked of physicians should be a great help to the patient in having a better understanding of the disease and what is required of him to remain in good health. The section on diet including menus and recipes is very complete and well written. The book is one that is not only valuable for the patient, but is also of value to the physician who needs all the assistance he can get in handling the problem of diabetes.

JOHN R. MEADE, M.D.

A MANUAL OF OPERATING ROOM PROCEDURES. Alvina W. Hoppe, Science Instructor, Jewish Hospital, St. Louis, and Lucile M. Halverson, Supervisor of Operating Rooms, University of Minnesota Hospitals, Minneapolis. The University of Minnesota Press (Humphrey Milford, Oxford University Press, London), 1937. Price $2.00.

As the title indicates, this volume is intended for the surgical nurse in the operating room. The supervision of a modern operating room requires much attention to detail if an operation is to proceed smoothly. The duties of the operating room personnel are outlined in detail, the care of materials, the preparation of patients, tray set-ups and, under separate headings, instructions for practically all operations are given in

minute detail. Representing, as it does, the technic used in two outstanding hospitals, its pages reflect the careful thought given by the authoresses. The volume should be of great value to surgical nurses, particularly those in charge of operating rooms.

C. B. D.

MATERIA MEDICA AND PHARMACOLOGY. H. A. McGuigan and E. P. Brodie. 580 p. Illus. $2.75. St. Louis, Mosby, 1936.

This book is an outgrowth of Brodie's Materia Medica for Nurses, but is much more complete. It has left out many of the older drugs which were used without any basis, but which have been handed down as being of value. The book is well written and the subject matter well classified. The sections on the action of drugs on the nervous system and on the vascular system are very complete. The illustrations make it easier for the students to understand the actions of drugs. The book should make a very good textbook for both medical students and nurses.

JOHN R. MEADE, M.D.

ENDOCRINE THERAPY IN GENERAL PRACTICE. 192 p. illus., $2.75. E. L. Sevringhaus, M.D., F.A.C.P. Chicago: Year Book Publ. Co., 1938.

This small book does not attempt to cover the entire field of endocrine literature but manages, in an easy-to-read form, to simplify and correlate the most important fundamental facts to serve as a background for intelligent endocrine therapy by the general practitioner. The author fully understands that any book written about glandular therapy is quickly outdated.

One of the most likely criticisms of this volume will undoubtedly be that the handling of the material is too elementary. This criticism is valid; but nevertheless the same criticism will recommend the book to those practitioners who on looking up references in the field of endocrine therapy are likely to become perplexed by the confusion that exists in terms, nomenclature, indications, and dosages. A careful reading may well result in a better understanding of indications and avoid the dangers of enthusiastic overtreatment as a result of commercial exploitation of endocrine products.—M. L. STRAUS, M.D.

A PEDIATRICIAN IN SEARCH OF MENTAL HYGIENE. Bronson Crothers, M.D., New York, $2.00. The Commonwealth Fund, Oxford University Press, 1937.

The fascinating title of this small volume recommends it at once. Anyone—pediatrician or other—whose resurgent hopes send him forth on so commendable a search deserves company.

The author "starts with a general survey of the situation as it relates to the practice of medicine and then goes on in a rather casual way to discuss the medical school and the teaching hospital." He closes with a description of a scheme for coöperation between psychologist and pediatrician as worked out at the Children's Hospital in Boston. That the author has achieved a sympathy with the psychologist may be surmised from his comment on the enterprise: "With full expectation of harmony on both sides, friction became evident almost from the start. Since this friction has, we both now believe, led us to an adequate and effective measure of coöperation, it is I think worth considering."—E. C. HARTLEY, M.D.

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